The Use of Technology to Access Healthcare: An Exploration of eHealth Literacy and Related Disparity in Bangladesh

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Table of Contents

List of Figures

List of Tables

List of Boxes

Page No.

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List of Abbreviations

A&E	Accident & Emergency
A2I	Access to Information
ACM	Association for Computing Machinery
AIDS	Acquired Immune Deficiency Syndrome
ANC	Antenatal Care
App	Application (mobile based)
ARPANET	Advanced Research Projects Agency Network
BDT	Bangladesh Taka
BKMI	Bangladesh. Knowledge. Management. Initiative
BMMS	Bangladesh Maternal Mortality Surveys
CA	Capability Approach
CAP	Community Access Point
CC	Community Clinic
CDMA	Code-Division Multiple Access
CF	Choice Framework
CHW	Community Health Worker
CMR	Child Mortality Rate
CS	Caesarean Section
CTA	Cognitive Task Analysis
DFID	Department for International Development
DHS	Demographic and Health Survey
DOI	Diffusion of Innovation
eHEALS	eHealth Literacy Scale
eHealth	Electronic Health
EIU	Economic Intelligence Unit
EmOC	Emergency Obstetric Care
EMR	Electronic Medical Record
EPI	Expanded Program for Immunization
FGD	Focus Group Discussion
FNF	Friend and Family
GB	Gigabyte
GDP	Gross Domestic Product
GNI	Gross National Income
GoB	Government of Bangladesh
GP	General Practitioner
GSMA	Global System for Mobile Association
HCI	Human Computer Interaction
HCI4D	HCI for Development
HDI	Human Development Index
HDSS	Health and Demographic Surveillance System
HEU	Health Economics Unit
HFA	Health For All

HIV	Human Immunodeficiency Virus
HRH	Human Resource for Health
icddr,b	International Centre for Diarrhoeal Disease Research, Bangladesh
ICT	Information and Communications Technology
ICT4D	Information and Communication Technology for Development
ICU	Intensive Care Unit
IDI	In-depth Interview
IDS	Institute of Development Studies
IHP	Informal Healthcare Providers
IRB	Institutional Review Board
ITU	International Telecommunication Union
JHUCCP	Johns Hopkins Bloomberg School of Public Health Center for Communication Programs
K4Health	Knowledge for Health
LMIC	Low and Middle-Income Countries
MAMA	Mobile Alliance for Maternal Action
MDG	Millennium Development Goals
mHealth	Mobile Health
MIS	Management Information System
MMR	Maternal Mortality Rate
MMS	Multimedia Messaging Service
MNCH	Maternal and Neonatal Child Health
MoHFW	Ministry of Health and Family Welfare
NCD	Non-Communicable Disease
NGO	Non-governmental Organisation
NHS	National Health Service
OECD	Organisation for Economic Co-operation and Development
OLPC	One Laptop Per Child
OOP	Out of Pocket
ORT	Oral Rehydration Therapy
PC	Personal Computer
PHC	Primary Health Care
PhD	Doctor of Philosophy
PISA	Programme for International Student Assessment
R&D	Research and Development
RQ	Research Question
SARS	Severe Acute Respiratory Syndrome
SDG	Sustainable Development Goals
SDH	Social Determinants of Health
SES	Socio-Economic Status
SIM	Subscriber Identity Module
SLF	Sustainable Livelihood Framework
SMS	Short Messaging Service
TFR	Total Fertility Rate
THE	Total Healthcare Expenditure
TRCL	Telemedicine Reference Company Limited

TV	Television
UHC	Universal Health Coverage
UK	United Kingdom
UN	United Nations
USA	United States of America
USAID	United States Agency for International Development
USD	US Dollar
VAS	Vitamin A Supplement
WHO	World Health Organisation

Summary

Given the development potential of technology, globally policy makers and other health actors are in the process of embracing Information Communication Technology (ICT) as a solution to various development challenges. However, this may result in inequitable access to services if the evident digital divide is not addressed. In Bangladesh, the digital divide may be the reason for the low use of Electronic Health (eHealth) to access healthcare as well as health information and services, despite huge household ownership of mobile devices, a large subscriber base and a strong political mandate. This thesis takes a bottom-up approach to understand what makes people access eHealth using their electronic devices and what barriers inhibit this action. Being inspired by the theory of diffusion of innovation, the Capability Approach (CA) and the choice framework, this thesis demonstrates, through a mixed method approach in semi-urban Bangladesh, that access to eHealth is influenced by socio-demographic dimensions and that this puts young and educated adults at the forefront of technological use. It further explains that it is also important to have eHealth literacy, which is a combination of health, information and technology literacy, to enable owners of devices to use eHealth to access healthcare. As sequential steps, the thesis presents a framework to shows how young and educated adults make use of their agency, resources and structural factors to attain (or not) eHealth literacy. Considering these steps as equity dimensions, this framework offers a philosophical and methodological reference point to policy makers and other relevant stakeholders in Bangladesh and similar contexts, for effective and equitable integration of eHealth to ensure access to healthcare by all.

Chapter 1 | Introduction

Would it be wrong to say that despite the world's material and technical achievements, society is still haunted by the behemoth of injustice? Centuries of knowledge, innovation and pragmatism and yet we find ourselves amidst social, emotional and political suffering. About 2.5 million years ago, life in the stone age was primarily the *struggle for survival* and involved sheltering to protect oneself from harsh environment or inventing tools for hunting. Today, we have enormous economic wealth, knowledge and comfort, yet so many of us are anxious and burdened with our lives. Humankind's journey from cave to a *smart home*[1] has been in so many ways a story of injustice. People who perhaps now live in smart homes may nonetheless be distressed by their psychosocial wellbeing with no or little communal life. And those who are somewhere in between the caves and smart homes are too experiencing similar challenges and possibly more. For the latter group, the circumstances can simply be a lack of access to safe drinking water, basic healthcare or education. The fact is, 'global inequalities in income increased in the 20th century by orders of magnitude out of proportion to anything experienced before. The distance between the incomes of the richest and poorest country was about three to one in 1820, 35 to one in 1950, 44 to one in 1973 and 72 to one in 1992' (Alston & Anand, 2000, p. 6). According to a report by Oxfam International in 2018, wealth rose by 2.5 billion US$ a day for more than 2200 billionaires while the poorest half of the global population lost 11% of their wealth. How ironic it is that the 26 richest people (billionaires) now possess the same amount of assets possessed by the poorest half of the world (Elliott, 2019; Oxfam GB, n.d.)!

Considering such a large rich-poor gap, a traditional approach for human development has been heavily centred on outcomes measured by economic gains; human wellbeing has been measured by income. Ground-breaking works in the 1980s by intellectuals like Amartya Sen and his colleagues led to the realisation that poverty is a complex state of a deprivation for a person or group, in terms of a wide

[1] According to a popular website, *smart home* is a residence that uses internet-connected devices to enable the remote monitoring and management of appliances and systems, such as lighting, heating etc. (https://internetofthingsagenda.techtarget.com/definition/smart-home-or-building)

range of personal and social factors. This was ground-breaking because human development was no longer a *top-down* concept. In an effort to make it a *bottom-up* approach, Sen has shown that human growth is related to a person's or group's health, education and housing-related deprivations, indicating wellbeing should be the way people value their life (Sen, 1999; Sen, 2005). In contrast to the traditional income focused definition of development, Sen's argument provided a fresh perspective to look at why different countries have different economic growth or why there is a lack of satisfaction and anxiety about life among the citizens of many developed countries. Or why, in low- and middle-income countries (LMIC), after billions of dollars have been spent in building them, modern and hygienic facilities remain grossly underutilised due to a lack of motivation or a lack of capacity building initiatives for the people. One must understand that development should have an impact on people's lives and not merely by improving their income status. As a result, nowadays the United Nations Development Programme refers development to the Human Development Index (HDI) which is comprised of health, knowledge and standard of living indices (UNDP, n.d.). This is very useful in understanding the contrast between material achievements and social failure globally, and what can we do to address it. In this thesis, I have taken up this *bottom-up* approach to understand access to health and aspects of development approaches to address access disparity in a LMIC context.

Like other social deprivations, health and poverty are intimately related. Considering the wealth of evidence, it will be a waste of time to explain how health is related to development in 2019. During the time of writing this thesis, I entered two key words, 'health' and 'development' in *Google Scholar* (https://scholar.google.co.uk/) and got six million hits. A large part of it was about biological development, the development of drugs or the development of a tumour. Also, there was a whole lot about how health is related to human development and how it is necessary for a productive life. A summary of this google based search on health and development tells us that poor people suffer from malnutrition and have limited access to healthcare, and thereby have poor health. On the other hand, people with poor health often lack productivity which leads to moving further down the poverty ladder;

to poorer socioeconomic status. Thus, poverty and health are very closely related and can influence each other in a vicious cycle.

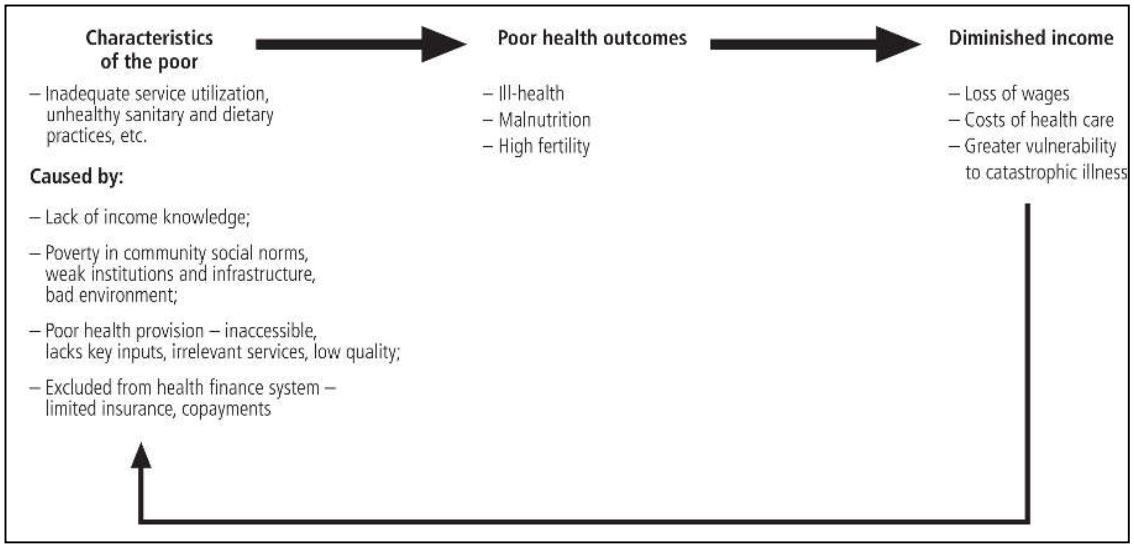


Figure 1.1 Health and Poverty Cycle

Figure 1.1 is a schematic depiction of the health and poverty cycle. It demonstrates two dimensions that lead to poor health outcomes for poor people: context and access (to health). The context of the poor is largely comprised of their poor living conditions, housing, sanitation and hygiene etc. From this perspective, context is a risk factor for the health of the poor. Also, the poor have restricted access to health services. This is mainly due to the unavailability of services or financial limitations compared to richer groups. If the services are offered by the for-profit sector, the poor are often excluded by the design of the service or by their lack of purchasing power (Wagstaff, 2002). Thus, health is more than a service and is intricately related to various social and economic aspects of human life.

The influence of health on human wellbeing is also acknowledged globally, firstly in the declaration of United Nations General Assembly in Paris on December 10, 1948, which proclaimed that health is a human right. Under article 25 (1), the declaration states that, 'everyone has the right to a standard of living adequate for the health of himself and of his family' (United Nations, n.d.). Due to the Paris declaration, health is now a formal development agenda. Before the adoption of HDI as a tool, there was no effective way to include health as an indicator of human development. Health in HDI has been included as the growth in life expectancy, assuming that in a developed society, people will live

longer. We do live longer now, but Sen has taught us that despite living longer, people may suffer from chronic deprivation and may not enjoy life to its fullest (Sen, 1999; Sen, 2015). Without considering the context and group specific socio-cultural factors and related access to appropriate healthcare, growth in life expectancy can be a superimposition of yet another top down indicator on what was previously called growth in income. Therefore, discussion of how health can contribute to development should focus on the status of disparities in health and how they are being addressed to ensure meaningful wellbeing of the people.

The world has experienced remarkable progress in various health indicators since the last century. At the beginning of the 20th century, the average life expectancy at birth was about 30 years, which rose to 65 by the end of that century. According to the World Health Organisation (WHO), we now live up to 72 years on average which is about a two and a half times increase in a little over a century (WHO, 2018a). We have eradicated deadly diseases like smallpox, introduced public health marvels like vaccines or oral rehydration therapy (ORT), made improvements in containing health threats like Ebola or Severe Acute Respiratory Syndrome (SARS), reduced the maternal mortality rate (MMR), the child mortality rate (CMR), and global annual population growth rate has decreased to 1.158 in 2015 from 2.059 in 1965; about 1.8 times reduction in 50 years (World Bank, 2018). However, these achievements vary across countries, regions or social groups.

Nonetheless, in spite of our achievements, we live in a world marked by health disparity; rich/poor families, developed/developing countries, men/women, age groups etc. Every day, 16,000 children die before reaching their fifth birthday. Just by being born in the poorest of families, the chance of death for children under five is twice compared to the richest families. African children have 14 times higher under-five mortality rate compared to the rest of the world (WHO, 2017a). In the last century (between 1970 to 2000), the life expectancy of an European child at birth has gone up by 30 years, whereas for South Asia and Sub-Saharan Africa, it has increased by 13 years and four months respectively (however, the Africa figure includes the Acquired Immune Deficiency Syndrome (AIDS) pandemic) (Marmot, 2007; UNDP, 2005, p. 19) (Figure 1.2). In 2013, the life expectancy at birth for both sexes in

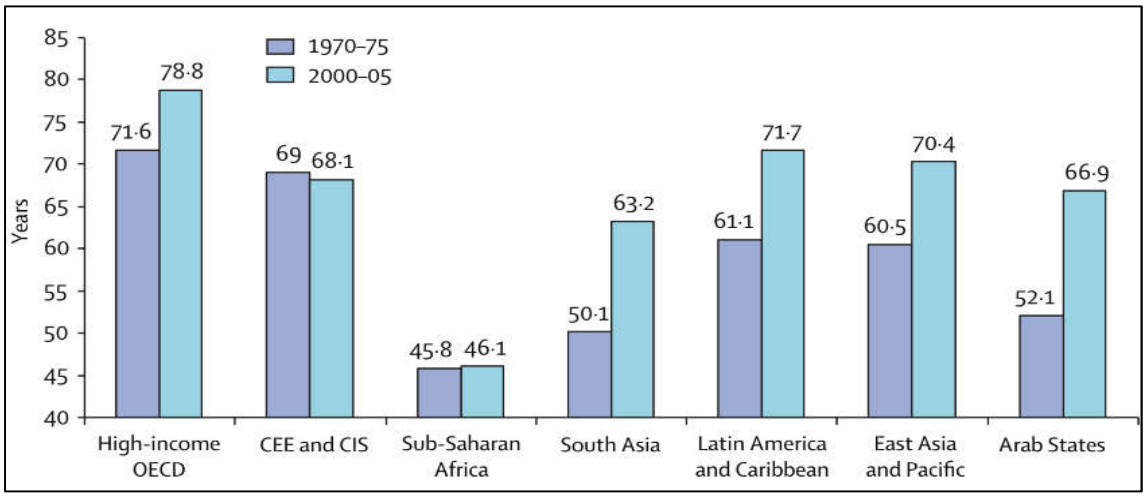


Figure 1.2 Life Expectancy at Birth by region between 1970-75 to 2000-05 (Marmot, 2007; UNDP, 2005, p. 19)

Europe was 76 years, while it was 58 in the African region. Similar disparities exist for child mortality. In 2013, the under-five mortality for both sexes in Europe was 12.2 per 1000 live births, whereas it was 90.1 per 1000 in the Sub-Saharan African region and 46.9 per 1000 in South-East Asia (WHO, 2015b, pp. 52–53). Developing countries also carry the burden of 99% of annual maternal deaths (WHO, 2011a). In Afghanistan and Somalia, over 1000 mothers per 100,000 live births die from pregnancy and child-birth related causes, compared to 21 per in the WHO European region. In 2013, 98% births were attended by a skilled healthcare professionals in Europe, compared to 51% and 68% in Africa and South-East Asia respectively (WHO, 2015b, pp. 90–91). Globally women are more vulnerable to suffer from health disparities. Women are not only prone to be sicker due to socio-cultural attributes and biological vulnerability, i.e. childbearing (Rieker & Bird, 2005; Song & Bian, 2014); studies have showed that women had higher prevalence of hypertension, chronic pain, cancer, anxiety and depression and more like to suffer from more days of disability compared to men (Perelman, Fernandes, & Mateus, 2012). In countries where women are responsible for fetching water, they have higher risks of infections from faecal-oral diseases such as ascariasis, diarrhoea, trachoma etc. (Caruso, Sevilimedu, Fung, Patkar, & Baker, 2015). Women also have less access to healthcare compared to men. A study of 156,887 male and female patients on the hospital medical record from 2003 to 2009 in China showed that males have higher duration of hospitalisation ($p<0.05$), higher expenditure (both self and public) for healthcare ($p<0.05$) compared to women. The study concluded that such differences occur due to unequal positions of

women in life and power, access to resources and services, risky behaviour and environmental exposure compared to men in China (Song & Bian, 2014). What is ironic is that much of this health disparity is theoretically preventable.

Apart from the biological reasons (i.e. disparity in health outcome due to genetic reasons or gender; men having a lower life expectancy than women), often health disparity is an expression of social-demographic influences over direct and indirect access to healthcare. In spite of the UN declaration in the late 1940s, health initiatives did not begin focusing on right based approach on a global scale, until the late 70s. By endorsing the provision of Primary Health Care (PHC) in 1978, the Alma Ata declaration became the cornerstone of *bottom-up* health initiatives to address socio-demographic barriers hindering access. PHC was specially designed to extend the coverage of essential healthcare to the vulnerable and marginalised. Then in the early 1990s, another movement called *Health For All* (HFA) was endorsed to further PHC. The main objective of HFA was to ensure that everyone has access to essential health services. Now we have Universal Health Coverage which envisions access to quality healthcare by all irrespective of financial ability.

To understand how these movements have ensured equitable access to health and to measure them against global development agenda, at the beginning of this century, eight development goals were adopted called the Millennium Development Goals (MDG), three of which were directly related to health: goals to reduce child mortality, improve maternal health and combat HIV (Human Immunodeficiency Virus) and AIDS, malaria, and other diseases (WHO, 2018b). In 2015, 193 countries endorsed 17 goals for continued global development to end poverty, promote wellbeing and protect the planet, commonly known as Sustainable Development Goals (SDGs). The SDG 3 focuses exclusively on 'ensuring healthy lives and promoting wellbeing for all at all ages.' There are 10 other goals and altogether more than 50 indicators related to health. This is a signpost that *health equity* is a global priority. There is ample evidence that access-related health inequity has been a major challenge to achieve sustainable development and wellbeing for all, and this evidence has resulted into global endorsement of Universal Health Coverage (UHC) and SDGs. Perhaps this has also led to a gradual adoption of development

concepts, research findings and methods by the health researchers, policy makers and others. This thesis assumes the premise that the adoption of development concepts/techniques is helping to reduce health disparity.

Development concepts and techniques have become a crucial part of understanding health disparities and ways to address those. The work on social determinants of health (SDH) is a an excellent example of how these sociological concepts have helped in realizing the true breadth and width of health, understanding the meaning of health as defined by WHO: 'Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity' (WHO, 2016a). Since the invention of ICs (integrated circuits), digital technology is driving global economic development. And the latest in this is the application of information communication technology (ICT), driven mostly by mobile-cellular technology and its rapid growth.

Globally, there has been a remarkable increase in the number of cell phones and internet users and the price of services and devices has gone down (Lewis, Synowiec, Lagomarsinoa, & Schweitzera, 2012; WHO, 2011b). It was a thriving market characterised by 7.7 billion (estimated) subscribers in 2017. The proportion of the global population covered by at least a 2G network grew from 58% in 2001 to 95% in 2015. Internet penetration grew from 6.5% (2000) to 43% (2015) and the proportion of households with internet access at home increased from 18% (2005) to 46% (2015) (ITU, 2016b, 2018). Given such growth, both national and personal spheres are now influenced by digital innovations; be it governments' strategies to expand coverage of their interventions by reaching remote areas, or individuals using it for everyday grocery or banking. According to the International Telecommunication Union (ITU), a 10% increase in the speed of the internet can increase economic growth by 1.3% in LMICs (Minges, 2016; Raul Katz, 2012). In 2014, the mobile-cellular industry generated three trillion United States dollars (USD), which contributed to 3.8% of global gross domestic product (GDP) and it is expected to rise to 4.2% by 2020 (GSMA Intelligence, 2015, p. 2). This economic contribution was made possible largely by connecting previously unconnected communities, financial inclusion through *eCommerce* and by designing and delivering innovative solutions for sharing information and providing

services etc. Examples include *Tigo Kilimo* by *Tigo* in Tanzania, launched in 2013 (GSMA Intelligence, 2015), Airtel Green SIM in India launched in 2007 etc. (GSMA, 2015, 2018) to provide agriculture based services *(eAgriculture), TradeNet* in Ghana (De Wulf, 2004), *bKash* in Bangladesh (bKash, 2017; Quadir, 2015) to provide financial services using the mobile wallet *(eCommerce* and *mCommerce). M-pesa* by Vodafone is one of the largest mobile-based financial services in the world, used by millions across Africa, Europe and Asia (Aker & Mbiti, 2010; Camner, Pulver, & Sjöblom, 2009; Vodafone Group, 2015). The ICT industry is now one of the most popular areas to work. In 2014, the mobile industry employed about 13 million people directly and supported 12 million more indirectly (GSMA Intelligence, 2015; Khalil et al., 2009; Raftree, 2018; World Bank, 2013). Then there is social media and networking which has an enormous influence over today's society. I tried to research the number of tech-solutions in development, but it is nearly impossible to pinpoint the exact number. Any simple relevant key words-based search on google will reveal that all types of stakeholders (private, public, non-profit etc.) are implementing tech solutions one way or another, but we know about the ones which have been proven to be successful, i.e. Tigo Kilimo, TradeNet, M-pesa etc. My interest is to understand how technology has helped in addressing disparity related to access to health.

Given the development potential of technology, globally policy makers and other health actors are also in the process of adopting digital means to address challenges of availability, quality and financing of healthcare. As a result, a growing number of events (conferences, workshops), websites, apps and literature are available explaining theories and implementations of eHealth and mobile health (mHealth) (Akter & Ray, 2010; Lewis et al., 2012; WHO, 2011b; World Bank, 2011). People are taking interest in all sorts of eHealth innovations; i.e. to extend geographic access, facilitate patient communications, improve diagnosis and treatment, improve data management, streamline financial transactions, and mitigate fraud and abuse in relation to healthcare etc. The designs of these platforms include the use of software (e.g. to enable data collection), voice (e.g. hotline/call centre), Internet (e.g. web site), text messaging (e.g. Short Messaging Service (SMS)) and videoconferencing (Akter & Ray, 2010; Lewis et al., 2012; Mechael et al., 2010).

For instance, the Mobile Alliance for Maternal Action (MAMA) is a SMS based maternal and child health initiative that is being implemented in Bangladesh, South Africa, India and Nigeria (MAMA, 2015). An open source SMS software called *FrontlineSMS* is being implemented for pandemic surveillance in western Malawi to help enable about 250,000 people to have access to emergency medical care, for tracking patients, documenting HIV and TB treatment adherence, and mobilising communities for outreach testing, providing information etc. A call centre called 789 (now called *myTonic*) being implemented by *GrameenPhone* (a mobile operator in Bangladesh) was started in collaboration with Telemedicine Reference Company Limited (TRCL) which was later ran by Dnet. It was designed to offer support for medical management of general health issues in Bangladesh (Akter & Ray, 2010). *Mobile-Baby* is working towards reducing maternal and child mortality by sending ultrasound images, video clips and 3D scans directly from ultrasound machines to mobile phones via SMS, Multimedia Messaging Service (MMS) and email to healthcare professionals for remote diagnosis in Tanzania and Nigeria (GSMA & GCWGD Alliance, 2015). These are a few examples of how technology is being used to deliver healthcare. My intention in this thesis is to critically look at eHealth provisions in a resource-poor setting to understand the role of technology in ensuring equitable access to health. But before that, what I think is critical and why, needs to be explained.

My critical stances for this thesis are; a. addressing health disparity is central to meet the challenges for global development to ensure everyone's wellbeing, b. the growth of technology and its innovativeness have a critical relationship with people's choice for it to be used (for own wellbeing) and c. technology has the potential to ensure everyone's access to health, however we need to understand people's perspective on eHealth and its use. Let me explain. Human wellbeing and health are intricately entwined and according to welfare concepts, wellbeing is human development. Health disparity is essentially a threat to good health and is embedded in a context of interrelated personal, social and political factors. When these factors act as barriers (individually or collectively) to access to healthcare, it causes a varied level of health within a society and eventually hinders human wellbeing. Access to health is also one of the indicators to measure progress of SDGs and therefore is a global development priority.

My thesis will demonstrate how these factors are related to access to health using electronic platforms and thus contributes to the present effort to integrate technology for human development.

I also think the global push towards integration of technology is influenced by primarily two factors: i) the billion-dollar software, hardware and internet industry and numerous interesting and innovative solutions designed to cater for human need and comfort and ii) the rapid growth of subscribers to and ownership of technology by people. I find that currently tech integration is in many ways a *top-down* effort and there is a dearth of evidence regarding people's choices relating to tech-based development solutions, in other words, a *bottom-up* approach. However, it is also true that many of such initiatives have been very successful, i.e. the mobile wallet for financial services. In addition, often the people behind these innovations conduct studies to understand community acceptability, skill and perception before implementing. But in my opinion, health is a different ballgame altogether. There is ample evidence that access to healthcare is deeply influenced by individual and community care-seeking behaviour; perception and preference regarding illness and healthcare alongside other societal factors.

In this thesis, I have presented the equity implications of eHealth in a LMIC context. I have focused on LMICs because health disparity is most pressing in low resource settings, especially with respect to access to health. According to WHO, the main barriers to accessing quality healthcare in LMICs are physical (geographical, availability etc.), financial, and also concern access to health information and acceptability related inaccessibility (WHO, 2015a), which are often magnified in LMIC settings. And eHealth has the potential to address all these barriers. Therefore, to study the equity implications of eHealth, LMIC is a justified choice and I chose Bangladesh. Why Bangladesh? Firstly, because a. Bangladesh has a rich landscape characterised by many eHealth initiatives, the involvement of multiple actors and stakeholders, a rapid growth of tech platform and a huge base of mobile-cellular subscribers. Furthermore, the country has an exclusive political mandate to push technology for human development, popularly known as Digital Bangladesh. And b. despite remarkable successes in health, Bangladesh has marked disparities especially regarding access to health. Therefore, due to the available eHealth initiatives and relevant policy and technical underpinning and presence of health disparity,

Bangladesh appears to be an ideal context to critically look at the role of technology (eHealth) in rendering access to health for all.

Chapter Two is the background of this thesis and discusses the measures of health disparity and how they can be applied to understand the equity implications of eHealth in Bangladesh. It critically reviews relevant literature and presents concepts, evidence and experience in relation to the implementation and use of eHealth in Bangladesh. The chapter is divided into two sections. The first section is about *equity and equality*. The aim of this section is to introduce various concepts of health disparity and how they can be used to understand the state of access to health. It also provides a snapshot of the state of access to health in Bangladesh. The second part of this section provides a critical view of the growth of technology globally and how this growth has been influenced by various socio-political factors. It explains how the global growth of technology, especially mobile-cellular and internet technology, is coupled with various socio-demographic disparities, popularly known as the *digital divide*. Then it moves on to discuss how the digital divide can influence eHealth implementations as well. The second section of the chapter discusses the landscape of eHealth and mHealth in Bangladesh. It presents evidence on various eHealth and mHealth initiatives in the country which are currently being implemented and actors/stakeholders who are involved with this implementation. Then it discusses current policy and political scenarios and evidence regarding the use of eHealth and mHealth in Bangladesh.

Chapter Three discusses theoretical aspects of the equity implications of eHealth. It mainly presents three theories in relation to wellbeing and technology and criticises those based on their relevance to this thesis. These theories are: diffusion of innovation which discusses the process of adoption of technology in a community the capability approach (CA) which presents philosophical accounts of wellbeing and how it is related to individual freedom, functioning and capabilities; and finally the choice framework which explains how various structural factors and agency are related to people's technology use choices. Based on the review of evidence and theories, this chapter summarises the discussion by presenting a conceptual framework that is tested in this thesis. Using the framework, this

thesis makes an attempt to understand the extent to which electronic platforms, access to mobile phones and the internet are affecting (reducing or increasing) disparity in access to healthcare by the people of Bangladesh.

Chapter Four describes the methods and materials that have been used in this thesis. A bottom-up perspective to understand equity implications was loosely operationalised as both social and subjective (individual) view of using technology to access health. *Access to health through electronic means* was operationalised if a person had ever used a cell phone or laptop (or both) to call or send text messages to a health call centre or had used the internet to access any health service or information about any illness or related health services. Considering these, the research explored the equity implications in three steps; a. by socio-demographic characteristics (age, sex, education, income), exploring which group has accessed health using electronic means and why; and b. exploring how technical skill has helped groups with highest use to access health through electronic means (considering technical skill as the primary reason for accessing health electronically) and c) the nature of the skills that can enable people to access health through electronic means. Therefore, the method of this thesis is essentially mixed method using quantitative surveys and qualitive interviews, discussions and observations.

Chapters Five, Six and Seven present analytical information on which socio-demographic group uses electronic means to access health, and further insights into the members of the highest-user groups, to understand the influence of technical skill on the use of electronic means to access health. It also presents an in-depth exploration of their skill, both observed and claimed (by the participants). Chapter Eight is the conclusion section and is the summary of the thesis. Based on the findings of Chapters Five, Six and Seven, I go back to the conceptual framework and discuss what part of it was assumed right and what part of it was found different. I then present a modified framework that shows how people develop their own skills (not only technical skills, but also skills in understanding the electronic and non-electronic part of eHealth-based care-seeking) and how they choose to access health through electronic means. I then argue that in a resource-poor setting, integration of technology into health systems using the

framework can ensure equitable access to health and thereby contribute to country, regional and global development.

Chapter 2 | The Context of Technological Growth and the Related Disparity Debate and How Growth can Influence Existing Health Disparity: Literature Review

I began my Doctor of Philosophy (PhD) work with the scientific curiosity to explore the potential use of technology to ensure everyone's health. The first question that I asked myself was: what is my context? The Cambridge Dictionary explains 'context' as: 'the situation within which something exists or happens' (Cambridge Dictionary, 2020). So, for my thesis, is it the country/region of the world? Is it technology and health? Or is it the disparities related to human wellbeing? I think it is all of these and there maybe more. In this chapter, I will discuss the present-day thoughts and evidence related to technology, disparity and health. This will help in unpacking these dimensions and link them to my inquiry. I will begin with a discussion of what I mean by technology, disparity and health in terms of my inquiry, and then I will summarise the relationship between these concepts and related dearth of evidence (to indicate the gap).

2.1 Technology and Development

Digital solutions have presented great potential in delivering information for personal and collective communication, such as adverts/campaigns over mass media; as well as both web and SMS based information portals, voice calls and community access point (CAP) based information centres. Perhaps a good way to begin the discussion of technology and development is to present a few scenarios:

A. Experience from a kiosk-based ICT service in three south Indian villages: three dimensions of use were identified; financial affordability, convenience of location and user specific content. On the content front, women expressed their preferences regarding women's or children's health, job skills and various training programs (Best & Maier, 2007).
B. People have different ways of using technology for information sharing and communication; experience from the US: a qualitative study of US high school seniors showed that young people have used different forms of ICT communication with adults and peers e.g. social networks for less intimate peers, chatting software for more intimate peers and emails for communications with teachers etc. (Agosto & Abbas, 2010).
C. People's perception can influence the use of technology; experience from Bangladesh: Bangladesh has made remarkable progress in adopting technology for development. Among others, agriculture is a popular field for the implementation of tech-solutions which provide access to updated and accurate farming- and market-related information for the farmers. Because of the low use of these services by farmers, a study was

conducted. According to the farmers, to access these services one need be *modern* (with exposure to the broader world), young and/or have children (Islam & Grönlund, 2011).

The scenarios here signpost that the growth of technology and its rapid adoption is not beyond criticism. And this is not the first piece using a critical standpoint to understand the role of technology in development (for this thesis, in a health context). What is common to scenarios A, B and C is that all three countries had a considerable base of mobile-cellular subscription during that time. These scenarios show how users' expectation of content, their preferences for choosing the communication method and perceptions towards technology can influence its use. One must note that these all three scenarios occurred about a decade ago and the subscription base has grown to be much higher. However, have these scenarios changed? If yes, then how much? In this section, I will discuss critical aspects of both the growth of, and access to, technology.

In a simplistic sense, technology is essentially a tool with a purpose to serve people. This can take the form of gaining an advantage over a struggle like the invention of wheel or discovery of fire in prehistoric times. Of course, there are other aspects of technology as well, like destroying the environment or fuelling a conflict. But my interest in technology is limited to its potential to ensure human development and by extension, human wellbeing. Because of its potential and role in promoting social changes and thereby contributing to development agendas, ICT is of great interest to development scholars and practitioners. It is acknowledged as information and communication technology for development (ICT4D). ICT used to be dominated by radio and television which has now been overtaken by recent advances in computer and mobile technology and of course most recently by the internet (Kleine, 2013, p. 6). While there is a growing pool of literature demonstrating the utility of computer, mobile and internet technology in human development, the integration of ICT within development has always been criticised due to the over-simplification of the role of technology. In 2004, Sein and Harindranath argued that there are two school of thoughts regarding technology and development; the enthusiastic group thinks that ICT will lead the way to development, while the pessimists think it will not, unless accompanied by social changes. Considering development as a process, they explained that there is a lack of conceptual clarity regarding how ICT can influence the factors that are necessary for

the process of development to take place (Sein & Harindranath, 2004). The role of ICT within development is yet to be fully identified or established and there is a lack of theorisation relating to the process of uptake. As I have mentioned before, this thesis is about the role of ICT as a tool to achieve equitable wellbeing (in this case, health) for the society. If there is an inherent lack of theorisation and conceptualisation, what is the impact of such rapid uptake of computer, mobile and internet technology for development and health? Perhaps this uptake has been led by the optimist camp.

As a continuation of media and ICT research for development, serious *tech-optimism* has led to a rapid uptake of computer, mobile phones and internet use. This is intended to create a transition to a knowledge-based society and facilitate the process of development. Considering the traditional view of development as economic gain, to some extent this is an extremely simplified view regarding the role of ICT for development as it over-appreciates the scope of technology and is inclined to be hyper-focused on the economic gains. Thus, it under-appreciates the role of socio-political and individual perspectives within the process of how people make choices and somewhat ignores its potential to shape the interaction between ICT and development (Kleine, 2013, pp. 1, 6). We should also keep in mind that there is evidence of several failed ICT projects due to various individual and socio-political factors such as lack of ownership and participation from the community and at-risk groups, over-enthusiasm of the service providers and lack of continuing commitment from the policy makers etc. (Heeks, 2002; Weigel & Waldburger, 2004). In the 1990s, many of the telecentre-based ICT projects were a failure primarily because of limited research and knowledge leading to a lack of sustainability, scalability and evaluation. For instance, India's Indira Gandhi Conservation Monitoring Centre, intended to be the national information system, was never operational in spite of yearlong planning, analysis and design work. Or South Africa's touch-screen kiosks for the rural communities of the north-west province failed due to a lack of use by the community. One of the reasons for the failure of one laptop per child (OLPC) project was the poor recognition of various challenges of community implementation of such project indicating the inherent technocentricity of its design. *Gyandoot,* a kiosk-based ICT project intended to improve access and use of government services for the poor villagers of Madhya Pradesh, India was launched in

2000. Findings suggested a low uptake of *Gyandoot* services by the villagers simply because of their preference for face-to-face interaction. Richard Heeks, a pioneer social scientist in the ICT4D domain has reluctantly used the famous medical joke to express the challenges of technocentricity of ICT initiatives; 'the operation was successful but unfortunately the patient died'. (Heeks, 2002, 2008, 2009; Sein & Harindranath, 2004; Tiwari, 2008; Weigel & Waldburger, 2004). This lack of conceptualisation/theorisation and contextualisation is very important for understanding the use of ICT services by people.

There is another aspect of technology and development and related access: the assumption that the rapid growth of the digital communications industry means people have increased access, i.e. ownership of devices or subscription is regarded as a proxy for access. This assumption has probably influenced the tech-optimists and policy makers to promote integration of ICT for human wellbeing. As mentioned in the introduction, it is a trillion-dollar industry and it is growing every day. This is growth as measured by increases in the number of subscription/users, growth in innovation, and in new technology and the money that is involved. When the statistics estimate that by the end of 2018, 3.9 billion people (51.2%) worldwide were using the internet,, it seems that half of the world is using internet or has access (ITU, 2019). Therefore, in theory, half of the world has access to any internet-based services. But there is plenty to understand about this growth if we want to understand access to ICT. There is evidence that this growth is intricately influenced by socio-demographic factors, i.e. varying levels of access to ICT for various socio-demographic groups: the *digital divide*. We need to better understand the gap between households, businesses and geographic areas at different socio-economic levels with regard both to their opportunities to access information and communication technologies (ICTs) and to their use of the technology for a wide variety of activities (OECD, 2001, p. 5). Since the 1990s, the digital divide has become a catchphrase in the discourse of disparities in access to digital platforms, both between and within countries (Badran, 2013, p. 5). Given the growing use of ICT to address health and other development challenges, the digital divide is one of the most powerful markers showing restricted access by people. It is important to note that considering the rapid growth of digital platforms, measures of

access to ICT is largely based on household ownership of - or subscription to -mobile-cellular/internet services and devices.

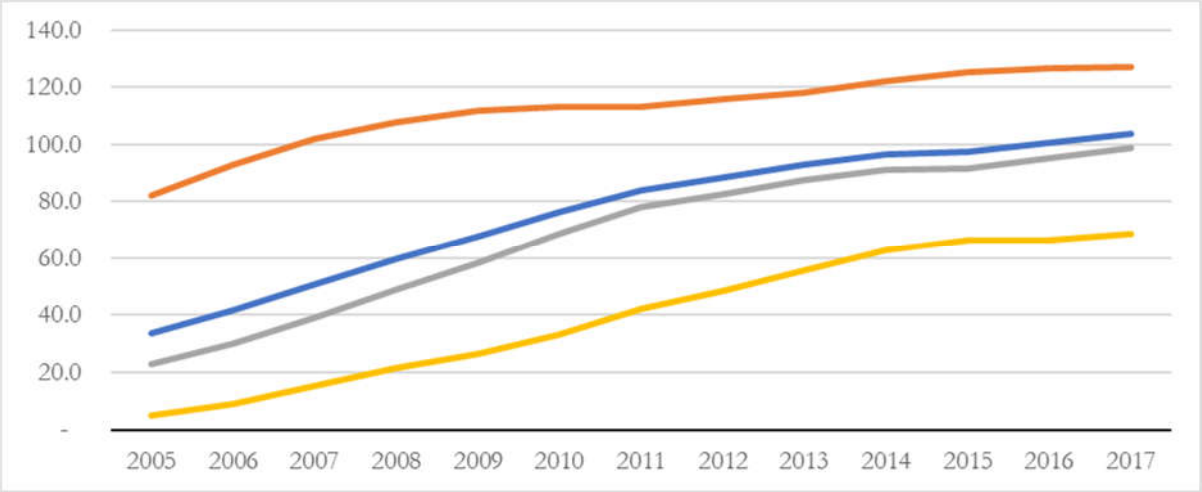


Figure 2.1 Percentage of mobile-cellular subscription per 100 people by world, developed, developing and least developed countries (LDCs) (ITU, 2018)

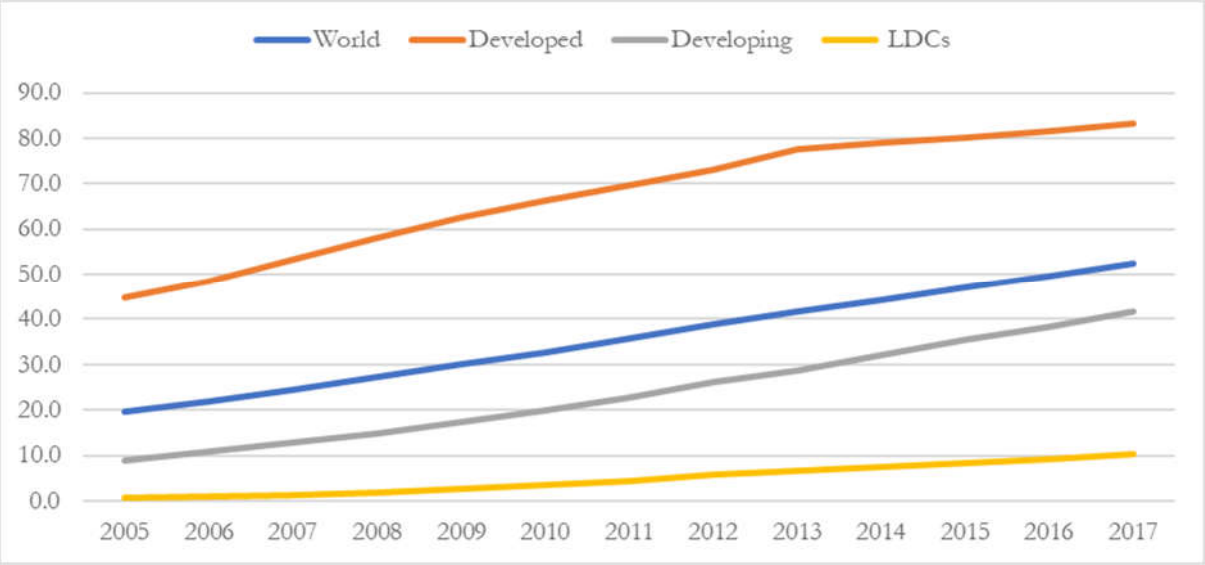


Figure 2.2 Percentage of households with access to internet by world, developed, developing and least developed countries (LDCs) (ITU, 2018)

One way to understand the digital divide is to view global subscription or ownership of ICT by wealth. The assumption is that the poor have less ownership/subscription and the rich have more. Figures 2.1 and 2.2 shows that developed countries are ahead in mobile-cellular subscription and household access to internet compared to the developing and least developed regions (ITU, 2018). About 15% of households in least developed countries has internet access compared to 84% in developed countries (ITU, 2017). Apparently, because of availability of more resources, the residents of the developed countries have higher access to ICT (Shih, Kraemer, & Dedrick, 2008, p. 44). The impact of

wealth and resources on access to technology can also be seen by countries. In 2014, access to broadband internet in India and Bangladesh was 1.24% and 1.19 % respectively, whereas in Switzerland and the United Kingdom (UK) it was 46% and 37.38% respectively (World Bank, 2014). However, it is important to mention that the wealth-based disparity between regions and countries in terms of access to digital platforms is getting narrower day by day due to the investment of the mobile-cellular industry and a reduction in price (Lewis et al., 2012). In 1999, most Africans did not have access to a mobile phone. In about 10 years from then (in 2008) about 65% of Africans had mobile phones and the proportion is still rising (Aker & Mbiti, 2010, p. 4). Given that a disparity is still there, wealth is an important indicator which influences access to ICT when viewed as subscription/ownership.

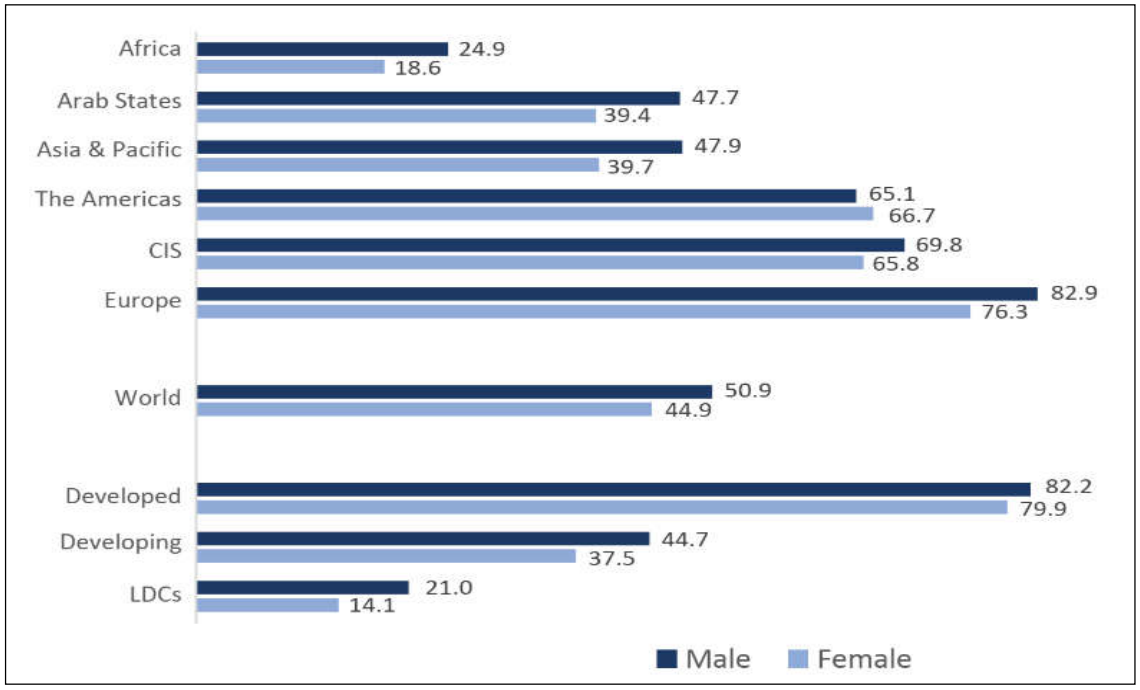


Figure 2.3 Internet penetration rate for men and women 2017 (ITU, 2017)

Access to technology varies by demographic and economic indicators, too. These include geographic locations (rural-urban), gender, age, education and rich-poor groups. Both Badran (2013) and Acilar (2011) show that urban localities have experienced most of the growth of ICT (landline, computer and internet) compared to rural areas. As for gender divide, globally women are 21% less likely to own mobile phones or go online (GSMA & Cherie Blair Foundation for Women, 2010, p. 15). Recent evidence from International Telecommunication Union suggests that globally, the proportion of women who use the internet is 6% less compared to men (Figure 2.3). Except for the Americas, everywhere in the world

women use the internet less than men. This gender gap in using the internet has become narrower between 2013 to 2017 everywhere except in Africa, where the gender gap was 20.7% in 2013 and became 25.3% in 2017. In least developed countries, the gap also rose from 29.9% to 32.9% in 2013 and 2017 respectively (Figure 2.4) (ITU, 2017).

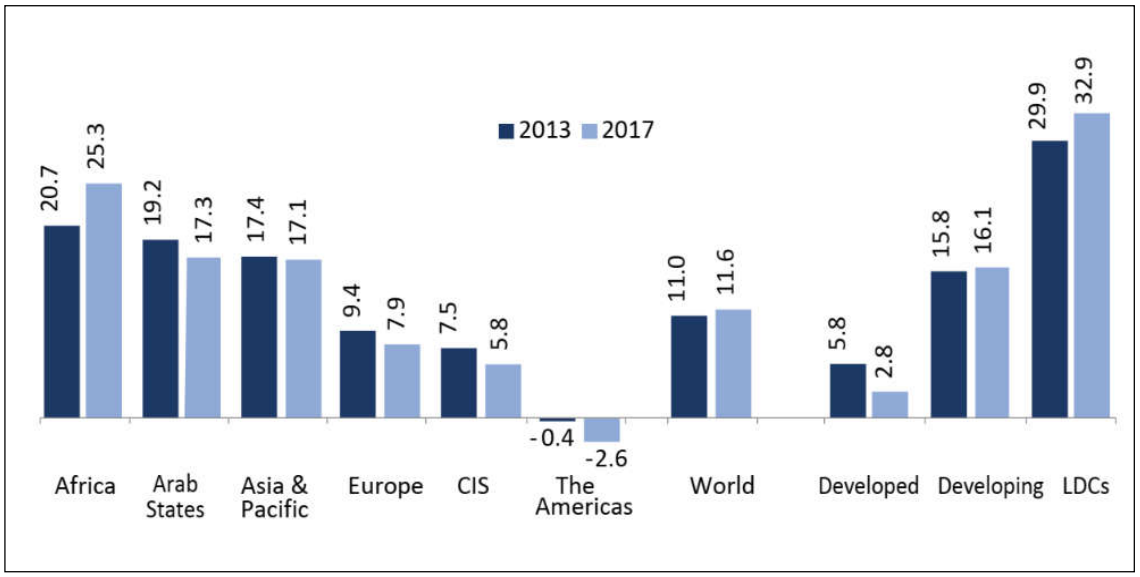


Figure 2.4 Internet user gender gap (%), 2013 and 2017 (ITU, 2017)

Apart from ownership, irrespective of the contexts, women are also reported to be more *technophobic,* which may be associated with women's economic status. On the other hand, men are reported to be more tech-savvy. Findings from 12 Latin American and 13 African countries suggest that women who are from socially advantaged groups are not generally technophobic. It concluded that the inequalities between men and women are very slim for both internet and mobile use when viewed as individual demographic groups. But it widens when access to technology is stratified by income, employment and education and gender: women have less access compared to men (Fallows & Pew Internet & American Life Project, 2005; Faulkner, 2001; Hilbert, 2011a; Puente, 2008).

Sometime, the gender divide can be narrower based on age group. There is evidence in both developed and developing countries that younger age groups have narrower gender divides for the use of ICT (Ono & Zavodny, 2003, 2007). But this has not been very conclusive. In 2007, an online survey of 2350 randomly chosen men and women in Britain suggested that there is a very small or no influence in terms of age or generation. Rather, offline factors like employment or marital status influence the

differences in internet use between men and women (Helsper, 2010). The growth of ICT has also contributed to creating opportunities for employment (World Bank, 2013). In India, ICT has surpassed agriculture in terms of contribution to GDP. But, people with higher economic status and education levels are gaining most (85%) of the ICT jobs (Bartolome, 2014; Upadhya, 2007). There is a gender differential in employment as well. In 2008, only 19% of the IT workforce was made up of women in India (Gillard, Howcroft, Mitev, & Richardson, 2008).

Similarly, age group has a profound influence over access to ICT platforms, especially from the perspective of use. A recent report by the ITU reported that globally 48% people use the internet while 71% of users are young people (aged 15 to 24 years). Clearly, in terms of access, LDCs are significantly behind compared to the rest of the world, but they are leading in terms of internet use by young people. In LDCs, about 30% of young people (aged 15 to 24 years) use the internet compared to 67% in developing and 94% in developed countries (ITU, 2017). A recent survey conducted by an international consultancy firm Deloitte among mobile phone consumers also indicated the same for Australia. The survey reported that ownership of smartphones is increasing among Australians and the younger adults (18-24 years) are co-leading with adults aged 25-34 years: both groups have 95% ownership of smartphones (Deloitte, 2017).

Access to ICT platforms can be restricted due to other socio-demographic factors such as race, ethnicity and education. A study among Caucasian, Filipino, Korean, and Latino Americans showed that the Koreans were more likely to own a mobile phone (83%) and computer (91%) and the Latinos were the least likely to own either (68% and 65%, respectively). It also reported that people with less education and non-native English speakers were less likely to own an electronic device or use the internet, in this case downloading health app (Bender et al., 2014). The evidence on the digital divide shows that the growth of the ICT market does not necessarily indicate universal access. If we consider the last study, the United States of America (USA) has 95% (estimated) ownership of mobile (PEW Research Centre, 2018), but as Latinos have 68%. Thus, without specific measures, any ICT based development initiative in America is likely to overlook the Latino Americans; at least for the time period of the PEW report.

Considering the tech-optimists and associated enthusiasm regarding devices, app/software and ownership, the digital divide is not just about understanding the socio-demographic and economic barriers in access. Designing a technological solution to deliver services for all requires a clear understanding of the needs, service-related behaviour and preferences of poor, vulnerable and marginalised people (Duncombe & Boateng, 2009). This means that the relationship between the growth of and access to ICT is influenced by the aptness or the capacity of an individual or a community with regard to the use of technology, popularly known as *eReadiness* or *technological readiness*. It is the extent to which a community is prepared to embrace technology for socio-economic changes (Đurek & Ređep, 2016). This readiness poses a critical question; even with high personal and household ownership (growth of technology), do we (as individual and/or as communities) have access to ICT? If not, then who has access and why? *eReadiness* or *technological readiness* includes three indicators: a. access to the internet (internet usage and mobile phone subscriptions); b. digital economy infrastructure (e-commerce, e-government and cyber-security); and c. openness to innovation (international patents granted, research and development (R&D) spending and the research infrastructure). Using these indicators, the Economic Intelligence Unit (EIU) conducted an assessment of technological readiness from 2013 to 2022 (actual and projected) among 82 countries. The report concluded that while Europe, North America and Australia are at the top, countries from Asia and Africa are mostly at the bottom (figure 2.5) (EIU, 2018,

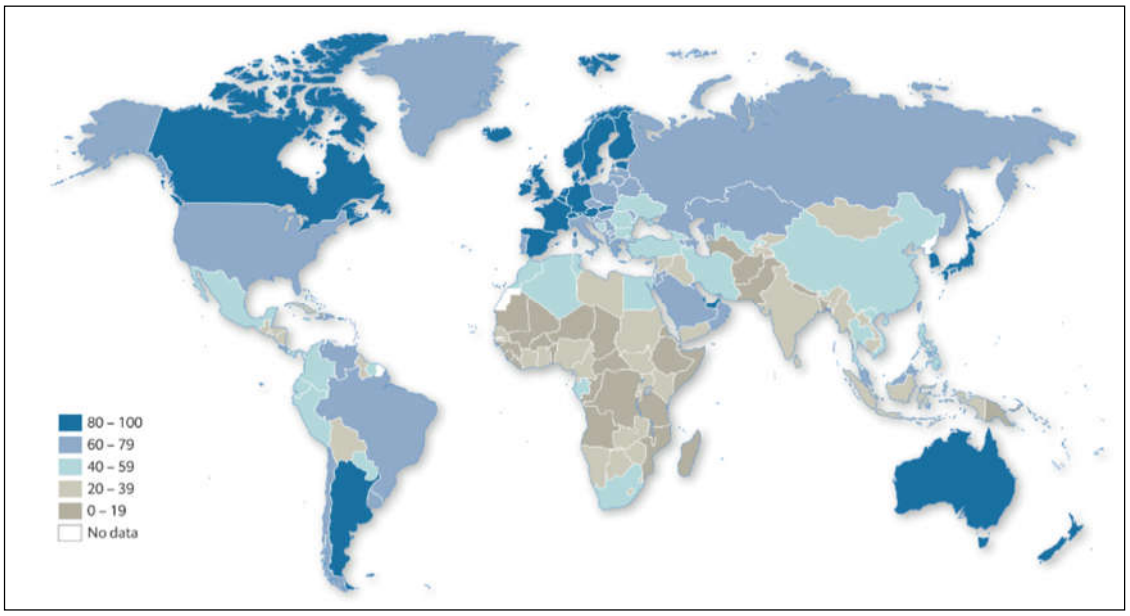


Figure 2.5 Global distribution of internet users (% of total population, 2016)

pp. 3–4). This is yet another critical perspective of the growth of technology telling us that while household or personal ownership of technology are crucial, it may not be enough, without readiness, to ensure access to development solutions through ICT. This is another picture of the digital divide based on a country's and people's ability to interact with technology.

Table 2.1 Skills required to seek electronic information using the internet

	List of Skills
Operational	1. *Operating an internet browser:* a. Opening websites by entering the URL in the browser's location bar b. Navigating forwards and backwards between pages using the browser buttons c. Saving files on the hard disk d. Opening various common file formats (e.g. PDF) e. Bookmarking websites 2. *Operating an internet-based search engine:* a. Entering keywords in the proper field b. Executing the search operation c. Opening search results in the search result lists 3. *Operating internet-based forms:* a. Using the different types of fields and buttons b. Submitting a form
Formal	1. *Navigating on the internet by doing the following:* a. Using hyperlinks embedded in different formats such as texts, images, or menus 2. *Maintaining a sense of location while navigating on the internet, meaning:* a. Not becoming disoriented when navigating within a website b. Not becoming disoriented when navigating between websites c. Not becoming disoriented when opening and browsing through search results
Information	1. *Locating required information by:* a. Choosing a website or a search system to seek information b. Defining search options or queries c. Selecting information (on websites or in search results) d. Evaluating information sources
Strategic	1. *Taking advantage of the internet by doing the following:* a. Developing an orientation toward a particular goal b. Taking the right action to reach this goal c. Making the right decision to reach this goal d. Gaining the benefits resulting from this goal

Interaction with technology needs a set of skills to engage with the hardware and software. Table 2.1 shows a list of skills that are required to access information through the internet (van Deursen & van Dijk, 2009, 2011). We often do not realize what skills are needed to browse Google or shopping on Amazon. This is because of the privileges in our lives where computers and mobile phones are taken for granted. These digital devices are ubiquitous and have crossed age barriers; from babies to the oldest of the elderly. Babies and toddlers watch their first nursery rhymes on YouTube, kids do their homework on laptops and adults are going paperless in their workplaces. While this has a beneficial impact in terms

of making lives more comfortable than before, the constant use of technology can be harmful for health. Although the biophysical or mental effects of technology are of great importance, it is beyond the scope of my research. What is critical for my thesis is to understand the specific set of skills needed to use technology to access healthcare. A child growing up in Brighton, UK is likely to have more skill to use technology than a child growing up in the Kibera slum in Nairobi, Kenya; geographical differences influence one's technical skill to use ICT. This is represented in Figure 2.5 in regard to internet use (EIU, 2018, p. 5). Often, we tend to conclude that people with higher socio-demographic status (educated, richer etc.) have more skill. This may not be always true. A survey among Tanzania's medical students showed low skill in using computers. From a list of 16 skills, 90% of the respondents could perform only two which were turning the computer on/off and using a mouse. Roughly 50% to 65% could perform tasks like printing, cutting and pasting, and saving data etc. (Samuel et al., 2004). Another survey of 811 Spanish adolescents in the US reported that 23.2% lacked the confidence or necessary skill to search for appropriate health information through the internet (Jimenez-Pernett, de Labry-Lima, Bermudez-Tamayo, Garcia-Gutierrez, & del Carmen, 2010). However, the general consensus is that, in terms of a skill-related digital divide, socio-demographic variables like gender, education, age and income are most important; and men, younger age groups, educated and higher income groups have higher skill levels compared to others (van Deursen & van Dijk, 2015; van Deursen, van Dijk, & ten Klooster, 2015).

Further to the influence of socio-demographic characteristics, digital skill is related to our exposure to technology. A toddler growing up watching cartoons on the internet will eventually acquire more skill compared to the ones who did not have that exposure. Analysis of the Programme for International Student Assessment (PISA) data of Organisation for Economic Co-operation and Development (OECD) from 2003 to 2006 showed that digital skill was not related to the ICT penetration rate, but it was related to access to ICT facilities at home ($F = 85.53$, $df = 153,891$, $p < 0.001$) and school ($F = 41.93$, $df = 7634$, $p < 0.001$) that promote digital skill for adolescents (Zhong, 2011).

Using technology is not just about skill, it is also informed by how people perceive technology and how a particular technology responds to one's need. While technology provides innovative means

for accessing resources and information, it remains subject to trustworthiness, acceptance and adoption by people. This is the primary focus of human-computer interaction (HCI) research, which examines the use of complex technology by people in everyday life. The Association for Computing Machinery (ACM) has defined HCI as: 'a discipline concerned with the design, evaluation and implementation of interactive computing systems for human use and with the study of major phenomena surrounding them' (Hewett et al., 1992, p. 5; Ho, Smyth, Kam, & Dearden, 2009, p. 1). This discipline studies the interconnections between computer science, human factors, engineering and cognitive science. Although HCI was initially dedicated to understanding the interaction between people and desktop computers, due to the advent of technology a large part of its focus is now on the use of the internet and associated portable devices (The Interaction Design Foundation, 2019).

Since the beginning of this century, a group of HCI researchers have investigated the design of various ICT4D innovations with a special focus on cross-cultural transfer of technology users' needs and infrastructure. These HCI for development (HCI4D) scholars like Paragas, Wyatt and Barnes, after careful consideration, have noted that current technology promotion, implementation and adoption is primarily driven by 'technological determinism', which explains how technology can shape social structure and cultural values. However one of the major criticisms of *technological determinism* is the assumption that technological innovations are not subject to societal influence and are based on technological soundness (Barnes, 2000; Dafoe, 2015; de la Cruz Paragas & Lin, 2016; Kline, 2015; Wyatt, 2008, pp. 173–175).

A combination of telecommunications, the internet and access to a device is the current technological combination adopted for development innovations. If we take ARPANET (Advanced Research Projects Agency Network)[2] as the prototype for the internet (in the 1960s), *Windows 1.0* (in 1985) as the driver of modern computing and *iPhone* (in 2007) as 'the magic box' for modern portable communication, all of these require some basic skills in order to access them. They require that a user

[2] https://www.history.com/news/who-invented-the-internet

understands how to type in words using a keyboard, to interact with a browser to access the internet, and to interact with a display in the form of reading (on computer or a phone), touching (touch phone, keyboard) and clicking (computer mouse). Hence the two basic requirements for a user to be able to interact with these technological innovations are sensorimotor ability to be able to use a display or keyboard, and cognitive ability to be able to understand how to interact with technology. These original prototypes have changed significantly since their original development: their appearances have changed, and software applications have been developed; however, these basic requirements have remained the same.

These modern means for improved and effective communication were designed in the US (Lukasik, 2011; Salus & Cerf, 1995). As a result, the primary market for these technologies has always been the developed world. Although some of the tech-giants are now based in the developing world (e.g. China), the basic design of the technology remained the same and so does the related interaction between the users and technology (Pearson, Robinson, Reitmaier, Jones, & Joshi, 2019).

The HCI4D researchers have pointed out that often, by the time developing regions have access to specific technological innovations (such as iPhones, Microsoft or Google), the design of the technology is established and there is little room for further modification based on the needs of users from developing countries. This means that its implementation is an appropriation of the basic form of the technology, trickling down from developed regions of the world (May, 2015; Pearson et al., 2017). This links to the above discussions on the digital divide and suggests that technology's ability to understand the needs, service-related behaviours and preferences of the poor, vulnerable and marginalised (Duncombe & Boateng, 2009) may be limited.

HCI4D research focusing on the interaction between such 'hand-me-down' technology and users from developing regions shows differences in experience compared to the developed regions. Considering the fact that users in developing regions have chronic challenges of physical, financial and experiential (educational, literacy and cognitive) accessibility, they have been recognised as *emergent* users in current HCI research (Devanuj & Joshi, 2013). Between June 2015 to September 2016, a series of

design workshops and conferences were held in India, Kenya and South Africa. The purpose of these workshops was to document both the expectations and preferences of the emergent users to help design mobile technologies that can help people to facilitate their day to day activities, exploring *user-centric* design for future mobile technology. This revealed a range of constraints related to the use of mobile technology in these and other developing countries. Although many users have access to devices, users of developing regions often have very limited access to the technical part of the technology such as data allowance or bandwidth which is crucial for web-based technology. In addition, access to accessories or secondary devices is very low. This is important if a mobile based innovation requires a secondary screen (i.e. laptop or projector) or headphones or microphones. Use of mobile technology is also affected if the users have less textual and/or computer literacy because it is largely developed by and for native English speakers. The physical designs of mobile phones are sometimes problematic, such as when – to perform a task – someone has to press and hold a button for a while and then release and choose an option. This requires high sensorimotor coordination. Sometimes interacting with widgets (i.e. a slider button or putting the phone on silent mode and back) can be difficult for a user and can result in the user rejecting the technology. Similarly, sometimes reaching a particular corner of the display while holding the phone can be difficult for some users. Users' experience can also suffer due to a lack of ability to share information. Information can be shared via web, Bluetooth or SMS and it may seem like an easy task for someone who is used to technology or for any digital natives. The study reported that for emergent users this was particularly challenging and discouraged group activities (i.e. sharing important news or other media content). Sometimes the unavailability of the desired information was a crucial factor influencing lack of use. This was particularly true for social media as many found it to be completely irrelevant and sometimes cumbersome to their everyday lives. Based on these findings, a number of technological innovations were designed, such as internet-free networking or appropriate social media content which was adopted by the Kenyan, South African and Indian people who participated in the corresponding workshops (Pearson et al., 2017; S. Robinson, Pearson, Holton, Ahire, & Jones, 2019; S. Robinson, Pearson, Jones, Joshi, &

Ahire, 2017; S. Robinson, Pearson, Reitmaier, Ahire, & Jones, 2018; Rosso, Coutrix, Jones, & Nigay, 2018).

Insights from HCI suggest that even for an apparently well designed and technologically solid internet-based development solution (including eHealth and mHealth) or having access to a smartphone does not automatically result in people benefitting from the innovation. Tech-innovations have distinct social, technical, technological and content-based dimensions which are influenced by economical, geographical, educational and skill-based factors at both the individual and community level. The evidences from HCI also cautions us from NOT assuming Google (or a computer or a smartphone) as THE solution to improve access to development and/or health services. To ensure that people are using, a technology-based development innovation need to be contextualized. And one of the ways to do this is through bottom up approach. Or in other words to view the USE (by people) through the eyes of an individual and/or a community (Ho et al., 2009; Jones et al., 2017; Robinson et al., 2012).

Up to this point, I have presented criticism regarding the growth of technology to show that growth does not mean universal access. And that the integration of technology for development gain has conceptual/theory related gaps. Thus, the access divide considering various personal and socio-demographic factors is perhaps the direct result of the over-reliance on the growth of the market. Furthermore, it is also true that without proper theorisation, it is very hard to address these complex and interconnected factors and thereby ensure maximum use of ICT for the betterment of lives. One must recognise that technology travels through various steps of adoption when introduced in a society. This is widely known as the theory of 'Diffusion of Innovation' (DOI), which can be one of the ways to explore the relationship between these personal and societal factors and their influence over access to ICT.

2.1.1 Process of Adoption of Technology in a Society and Related Criticism; a Potential Approach to Understand the Growth of and Access to Technology

Access to technological innovations in a population is not always certain and uniform. It varies based on the range of social groups, population-specific factors and characteristics which are related to access to knowledge and willingness to use technology. This interrelation is described in the theory of

DOI (Figure 2.6). It explains that the spread of innovation requires different routes over time to reach a society (Rogers, 2003; Scott, 2012). According to the theory, diffusion requires a society which is open to a number of channels of communication (i.e. external – government policies, mass media, various organisations etc. and internal – interpersonal networks, community leaders etc.), through which knowledge of innovation (technology in this case) reaches people (adopters) over a period of time. Perhaps a better way to understand time is to interpret the process of diffusion; how it is happening. Generally, a diffusion occurs in a society in five steps: knowledge (exposure to the innovation), persuasion (people's attitude resulting in seeking more information about the innovation), decision (people's acceptance or rejection of the innovation), implementation (adopting the innovation on a trial basis) and confirmation (people's final acceptance or rejection of the innovation). The theory describes people's interaction with the knowledge of technology and individual and/or group characteristics; diffusion's relative speed of adoption varies according to the groups of adopters. There can be five groups of adopters: innovators (the most enthusiastic, risk-taking social group, usually young), early adopters (the second most enthusiastic, also risk takers and usually young), early majority (usually with limited social exposure, less risk-taking and often rigid towards new ideas especially in relation to financial expenses), late majority (often sceptical towards new ideas, adopting only after observing the result of adoption by the majority of the community) and laggards (usually from the advanced age groups, with least financial ability, traditional in nature and the last one to adopt) (Rogers, 2003).

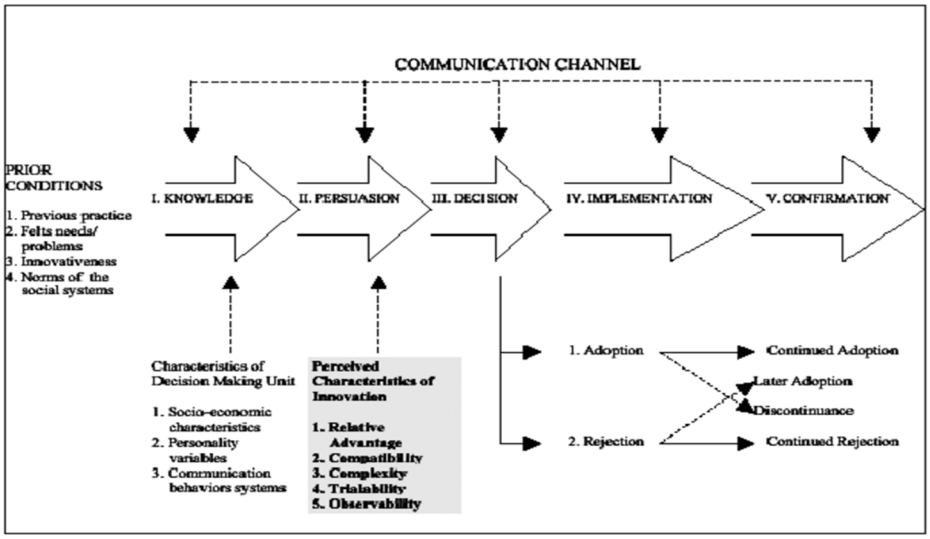


Figure 2.6 Schematic presentation of stages of diffusion of innovation (Rogers, 2003)

Since it was first published in 1962, Roger's DOI Theory is probably one of the most well-known and adopted theories in the field of innovation, including among development researchers and practitioners. A vast number of publications (more than four thousand) across many disciplines have presented views and experience based on DOI theory. Perhaps its fluid and non-specific way of describing innovation has led to such widespread adoption (Greenhalgh et al., 2005; Greenhalgh, Robert, Macfarlane, Bate, & Kyriakidou, 2004). Because it was developed from a series of social observations and experiments, and from a review of relevant social science literature, it is perceived to be practical and still relevant and thus widely used. However, the theory tends to quantify the adoption of innovation without paying much attention to subjective differences in interacting with information, and the inherent complexity of the social network and its influence on people's lives (Damanpour, 1996). For example, in case of new medical technology, the DOI theory fails to consider all factors relating to a community that could explain its adoption. Often such adoption comes with newer complexities regarding its clinical implementation, infrastructural and organisational capacities, people's interaction with information, socio-political and system-related challenges and how they are related with each other (Plsek & Greenhalgh, 2001). Although the adoption of DOI theory is assumed to be practical, because of its inherent techno-deterministic approach the experience of implementation is often inconsistent, especially when compared to similar initiatives. Also, the theory begins with an assumption that all innovations add positive value to the society which later Roger himself explains as *pro-innovation bias* (Karch, Nicholson-Crotty, Woods, & Bowman, 2016; Rogers, 2003). This undermines the cultural values and expectations of an innovation, which are critical to adoption of an idea or innovation, both for a person or a community.

Box 2.1: Measures of access to technology

- WHO (individual, organizations, communities, societies),
- WHICH characteristics (income, education, geography, age, gender, ownership)
- Connected HOW (use, adoption)
- WHAT type of technology (phone, internet, computer, SMS)

Being a *tech-enthusiast* myself, what is often baffling is how defensive I get when I hear criticism (in this case negative or pessimistic remarks) of technology and its use. And usually the response is to reject the critic as a *tech-hater,* a sceptic. We often fail to see that technology is only

effective when the growth is coupled with its use. As the famous novelist Sir Arthur C. Clarke once said; *'Before you become too entranced with gorgeous gadgets and mesmerizing video displays, let me remind you that information is not knowledge, knowledge is not wisdom, and wisdom is not foresight. Each grows out of the other, and we need them all.'* It is important to understand that today's tremendous growth of ICT industry is coupled with a failure to include societal and individual characteristics and perceptions, especially when viewed through a development lens. And a simple expression of this is the ongoing access related disparity; the digital divide. To understand how technology is related to development, the focus should be on: a. how it is being used by people, b. skills, c. how it is related to various forms of communication and d. the landscape of the context (Bar & Best, 2008; Galperin, 2010; Heeks, 2009; Khalil & Kenny, 2008). Hilbert (2011b) proposed a set of sequential questions (Box 2.1) that summarise how this interrelation can be studied. It explains that barriers to access digital platforms can be described as in terms of socio-demographic groups (gender, income status, location, education, ownership); material (type of device/software/network); and use, skill and people's preferences (as in perceived benefit, content etc.) (Acılar, 2011; Fuchs & Horak, 2007; Hilbert, 2011b). There is also a need for conceptual and philosophical direction to ensure a *bottom-up* approach in the implementation of technology for development. In the next section I will discuss aspects of disparity and how we can apply these concepts to study health-related disparity. I will come back to technology again (eHealth and mHealth) and discuss its equity implications and related gaps.

2.2 Disparity and Health

Over the past few decades, health system research across the world has studied various aspects of health-related disparity and how innovative approaches can improve the situation. These decades of experience suggest that the nature of innovation varies from context to context and country to country. The most recent addition to this collection of evidence is a book that, through case studies, has demonstrated the success factors for reforms aiming to improve health-related access in 60 countries.

The book, entitled 'Health Systems Improvement Across the Globe: Success Stories from 60 Countries', presents case studies based on policy changes focusing on economic, methodological, implementational and practice related factors. Considering a wide range of reforms the book concluded that the following four principles were significant success factors (Braithwaite, Mannion, Matsuyama, Shekelle, Whittaker, & Al-Adawi, 2017):

a. 'Acorn-to-oak tree' principle (a small-scale initiative leading to system-wide reforms). Investing into small projects like pilots or modest innovations have helped to shape the environment to achieve UHC in countries like Iran, New Zealand, Estonia, Ecuador and Fiji.

b. 'Data-to-information-to-intelligence' principle (the role of IT and data are becoming more critical for delivering efficient and appropriate care but must be converted into useful intelligence). By using technology for the collection, analysis and dissemination processes required to translate information into intelligence, countries like Chile, UAE, South Africa, Ireland, China and Italy have made considerable improvements in providing high quality and safe healthcare.

c. 'Many-hands' principle (intensive interaction between stakeholders is key). System strengthening to help key stakeholders to create and continue effective interaction can help in making evidence-based decisions. This can drive implementation of relevant polices and influence the delivery of healthcare. Countries in Latin America (Mexico and Venezuela), the Middle East (Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, the United Arab Emirates and Lebanon), Europe (Portugal) and Africa (Nigeria, Ghana) have already made considerable progress by fostering such relationships between the stakeholders.

d. 'Patient-as-the-pre-eminent-player' principle (placing patients at the centre of reform designs is critical for success). By adopting a patient-centric approach and focusing on their wellbeing, countries like Northern Ireland, Germany, Denmark, Guyana, Hong Kong and Malaysia have made remarkable progress in their health systems.

However not every country has been able to achieve the desired reforms to ensure access to healthcare. This indicates that while these principles have worked, they are also dependent on certain structural factors. As with other development issues, health is influenced by macro issues like the socio-political system of the country (Braithwaite, Mannion, Matsuyama, Shekelle, Whittaker, & Al-Adawi, 2017; Braithwaite, Mannion, Matsuyama, Shekelle, Whittaker, Al-Adawi, et al., 2017).

Thus, considering the growth of technology and existing disparity in health, the main objective of this thesis is to understand the nature of unequal distribution of health outcomes and how can they can be mitigated through eHealth and mHealth so that everyone can enjoy a prosperous life. As mentioned in the introduction, ICT growth has opened up an excellent opportunity for development (including health) professionals, and it is being integrated as a development solution rapidly. In the previous section, I have presented the main criticisms of this growth and discussed the associated access disparity. This sets the background to the adoption of ICT for healthcare access for all and signposts the embedded risks of creating deeper divides. In the next section I will discuss aspects of health-related disparity; as well as concepts and determinants.

2.2.1 Health Disparity: Concepts and Perspectives

Health disparity is inherently complex and multidisciplinary. While in a simplistic way it refers to the differences regarding health status and outcomes, the exact meaning is rather convoluted. Variation in health status is the main concern in health disparity studies. However, variation between or among what? As mentioned earlier in the introduction, nearly 50 years ago the very realization that states of health vary from person to person, group to group and country to country led to a movement called 'health for all by 2000.' People (and countries) joined their hands together to combat health inequalities and embraced primary healthcare, an organising principle that defined a version of global health: everybody is entitled to the highest possible standard of health (WHO, 2003, pp. ix–xii). This implies a certain standard of healthcare should be available for and accessible to everyone with any health issue; a provision of equal opportunity for everybody. However, health continued to remain unequal. From a conceptual viewpoint, there is a general consensus that health disparity does not encompass all variations

but refers specifically to those that impact vulnerable and marginalised groups negatively. This indicates that it is also important to recognise the needs of disadvantaged groups and manage the provision of healthcare and corresponding allocation of resources. Therefore, disparity is not only about equality, but it is also about equity, especially in regard to health outcomes for deprived people. Equity is the fair distribution of scarce resources; distribution according to need (Braveman & Gruskin, 2003; Dehlendorf, Bryant, Huddleston, Jacoby, & Fujimoto, 2010; Mooney, 2000). Considering the enormous pool of literature on this, I will briefly summarise the dimensions and principles related to health disparity below. Health disparity is a relative concept, which is commonly expressed as variation in health outcomes, i.e. presence or absence of disease (Hepworth, 1997). In that sense, it is primarily a biomedical concept based on the epidemiology of disease: incidence, prevalence, mortality, disability etc. Therefore, to biomedically understand health disparity, we apply these epidemiological indicators to compare who has the disease and who does not (Boutayeb & Boutayeb, 2005; Braveman et al., 2011; Braveman & Gruskin, 2003; Dean, 2013; Hajizadeh, Sia, Heymann, & Nandi, 2014). Considering disease as a health outcome, a biomedical concept of health disparity is very effective. Through a quantitative approach, this helps us to establish a causal relationship between exposure and outcome for a specific group of people. While the biomedical approach to understand disparity can be effective in establishing its presence, it is not suited to indicate the cause of disparity or the ways to mitigate those causes for better health outcomes.

Figure 2.7 Twelve Dimensions of the Proposed Community Contextual Health Profile (Hillemeier et al., 2003)

One drawback of the biomedical approach is that it is entirely dependent on epidemiological proof. In real life, disparity is not always revealed through health outcomes such as mortality, morbidity or incidence. It is now well recognised that health outcomes are the result of considerable interaction among complex contextual factors (Figure 2.7). And many argue that health disparity is essentially related to these factors, which altogether hinder access to healthcare and thereby affect health outcomes. This makes access to health an important part of the health disparity discussion. (Bircher, 2005; Bloom, 2000; Braveman & Gruskin, 2003; Davies et al., 2014; Hepworth, 1997; Hillemeier, Lynch, Harper, & Casper, 2003).

Access to health is one of the most effective and popular ways to study the causes and mitigation of health disparity. Before I discuss the dimensions of access (and related contextual factors), it will be important to explain what is meant by access and how it contributes to the disparity discourse. First of all, discussion of access to health is probably as old as health disparity. In a simple sense, access to health is the *opportunity* and the *act* of availing quality healthcare by people in *need* (Gulliford et al., 2002). However, it is not as simple as it sounds. *Opportunity, act* and *need* are highly contextual and can vary depending on people's preferences or system responses. People can be treated unjustly even if they are treated equally. For example, healthcare can be available to a community; however, it may not include a specific service that is very important for a group of people in that community. Therefore access to healthcare can be thought of as 'ability to ensure a set of healthcare services, at a specified level of quality, subject to personal convenience and cost, based on specified amount of information' (Oliver & Mossialos, 2004, p. 656). However, the *ability* is not universal, meaning the *ability* to access a set of healthcare services varies by groups based on need. First of all, if everyone is treated in the same way this is *equality*. For example, the provision of PHC is designed to provide the same set of services for everyone etc. In the study of disparity, this is called *horizontal* or *formal equity:* where all people with equal/similar needs are treated the same way. But what if the PHC services are located in a region known to be an endemic zone for dengue or malaria or goitre? Will the PHC based on equality or the horizontal equity principle be able to provide access to healthcare for all? Thus, the *vertical* or *proportional equity* principle

suggests that people with greater need should be treated with more attention than those with lesser need (Culyer & Wagstaff, 1993; Culyer, 2001; Sutton, 2002). These two principles are applied to both expressed and unexpressed needs. Expressed need is simple; I have got chest pain and I expect relevant care. But unexpressed needs mostly require preventive and primordial care, i.e. immunisation services, water and sanitation services etc. The most important point to note here is that access to healthcare is very much related to need, almost as if need acts as the rationale for access. It also helps us to relate the disadvantaged groups to the current state of access, i.e. how the current PHC provision is treating poor or pregnant mothers etc. And thus, access to health can be an effective way to understand the status of health disparity in a community or country. However, there are different schools of thought regarding its dimensions.

In 2005, WHO member states endorsed the resolution for UHC which has defined access as financial affordability of quality health services by all (Carrin, Mathauer, Xu, & Evans, 2008; Jacobs, Ir, Bigdeli, Annear, & Van Damme, 2012). Since then, it has become the face of the fight to reduce health disparities across the globe. This has resulted in an overwhelming push towards interventions that aim for financial protection from catastrophic healthcare costs, especially in LMICs. One popular model is risk pooling through community-based health insurance interventions. The idea behind this is that people often fail to avail themselves of health care due to high out of pocket expenditure, and financial interventions can protect people from this cost and thereby can ensure access to healthcare. One major criticism of this UHC led idea of access is that in the context of health disparities, one must also take note of factors which lead to a healthy life, not just health services. In resource-poor settings, food, water, sanitation, knowledge and education, and economic status can also influence access to health services (Jacobs et al., 2012; Marmot, 2006; Peters et al., 2008). For example, even with equal need and equal opportunity, one may access healthcare differently due to individual preferences. Or accessing healthcare can differ simply because someone is better informed and/or more adept at accessing it than others. In many LMICs, due to medical pluralism, village doctors, drug sellers, quacks and traditional healers are first line of choice for healthcare. Keeping the dimensions of UHC in the centre, Peters et al. (2008) have

presented a framework that summarises the central dimensions of access: geographical accessibility, availability of healthcare, affordability and acceptability of services (Figure 2.8).

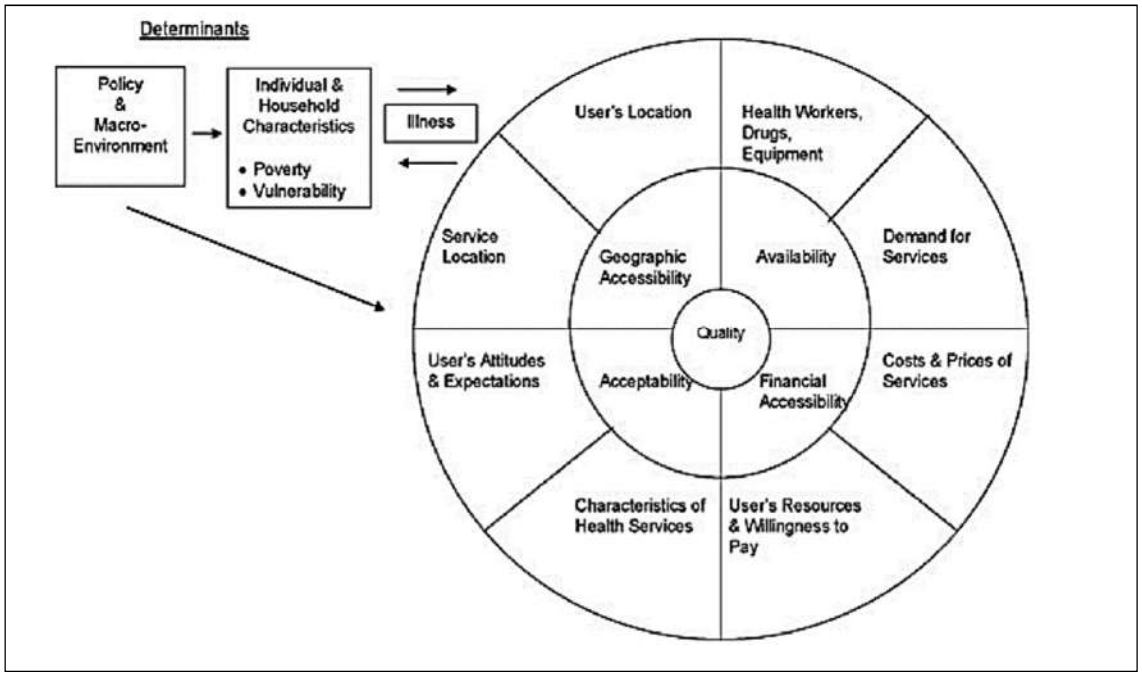


Figure 2.8 Conceptual framework for assessing access to health services (Peters et al., 2008)

The framework begins with defining the characteristics of the intended services, represented by the *quality* at the centre of the framework. It largely refers to the *technical* ability of the service provision to affect people's health, such as the characteristics of service provision and providers (supply side). This includes: hospital environment, availability of required instruments, informed and effective health staff etc. This conceptual framework (Figure 2.8) also considers a set of determinants which influence characteristics of healthcare provision: structural and population factors. The structural determinants relate to the macro environment, and include policy and strategy, financial crises, inflation etc. in relation to health. This is evident in the case of poverty; developing countries have 90% of the global burden of disease but account for only 12% spending on health (cf. Hart's inverse care law (Gottret & Schieber, 2006, p. 3; Peters et al., 2008)). The population determinants are various socio-demographic determinants, various social groups and related household characteristics.

Considering the health care provision and the structural and population determinants, in case of illness (need), according to the framework (Figure 2.8) there are certain characteristics of a healthcare

provision which helps us to understand the level of access to health. These are a. availability (e.g. absenteeism of the healthcare providers, waiting time etc.), b. cost (financial affordability), c. geographical accessibility (location of services and people – urban biased distributions of health workforces) and d. acceptability of health services (people's expectations, and the characteristics of health services – formal vs. informal services).

Access to health should be a pathway which refers to the availability of healthcare as soon as people feel the need, e.g. in case of illness. In that way, it is both opportunities to access, and use of, quality health services. The attributes in the conceptual framework also consider both. However, the framework does not show the influence of social and behavioural aspects, which are essential for shaping people's preferences and choices regarding what type of care is be sought when they are in need (Culyer & Wagstaff, 1993; Culyer, 2001; Jacobs et al., 2012). The framework also does not consider providers' behaviour and interaction with people, which is an essential part of the quality of service. The quality mentioned in the central circle is the technical quality. However, quality can be *perceived* as well; the way people recognise healthcare to be of good quality (demand side). From community view point, the provider's quality lies in their expertise (i.e. their knowledge, qualifications and/or skill) and the outcomes of patient-provider interaction (people's experience of care seeking) (Dagger, Sweeney, & Johnson, 2007). The other social and behavioural aspects missing in the framework, which others have found integral to access to healthcare, include: a reduced of sense of entitlement in the poor, a lack of task shifting, responsiveness of the providers (i.e. late referral), means of transport, dualism and absenteeism (by the service providers) and a lack of awareness in communities (Ahmed, Petzold, Kabir, & Tomson, 2006; Bigdeli & Annear, 2009; Jacobs et al., 2012; Kiwanuka et al., 2008).

I have briefly mentioned utilisation of services as part of access to healthcare, which needs more discussion. Utilisation can sometimes be used as a proxy for access and related disparity. People with equal need may show different rates in using healthcare due to socio-cultural influences. For example, a high use of surgical services among the higher income groups compared to the lower income groups may be due to financial ability. However, differences in the use of healthcare among people with equal need

due to social or economic barriers is indicative of inequity. Sometimes outreach schemes are required to provide services to people living in the periphery, or provide religiously acceptable methods for family planning where required for a religious community or make other adaptations to provision. (Ghosh, 2014; Oliver & Mossialos, 2004).

Based on the literature review, I have found that there are three types of health disparity research, generally: one that establishes the presence of health disparity; one that explains the associated causes; and finally one that provides solutions to mitigate the cause, to eliminate health disparity (Dehlendorf et al., 2010). The discussion here helps us to apply the concepts of access to healthcare to understand the causes and mitigation approaches to alleviate (or at least reduce significantly) health disparity. In the next section, I will briefly present a comparative scenario of how technology is being integrated with health and then discuss a framework for access to health that is more suited for the current world where technology is a dominating force.

2.2.2 Reducing Health Disparity: Possible Domain for Tech-Integration

The integration of technology within a health system is often referred to as a 'digital health innovation system', the integral parts of which are: a. technological tools, b. an innovative approach to connect people to the health system (health services and/or health information) and c. a supportive environment of policy and multi-stakeholder collaboration. While these three aspects are the building blocks of a 'digital health innovation system', they can also be viewed as indicators or themes to help identify best practice (providing illustrations of how technology has been integrated within respective health systems) and of sharing information across contexts (Iyawa, Herselman, & Botha, 2017; Iyawa, Herselman, & Botha, 2016). As in other development domains, technology in health seeks to connect previously unconnected people or groups, and to address access disparities. There are examples from developed countries where technology integration is helping health systems to improve access-related health disparity. One such example is the National Health Service (NHS) of the United Kingdom (UK).

The UK's NHS has been one of the major political mandates of the UK government, intended to ensure equitable access to health. Since its launch in the late 1940s, government spending on health

has increased significantly, and in 2017 this amounted to about £200 billion, 9.6% of the UK's total GDP (Office for National Statistics, 2019). While the NHS is often criticised with respect to efficiency and quality, it is regarded as one of the most effective health systems in the world. Keeping the criticism aside, it has considerable success in ensuring equitable access to quality health services, health system performance-wise; appointment scheduling which can be online, via SMS and or via a dedicated call centre (known as 111) in conjunction with the previous system of calling the General Practitioner (GP), the emergency call centre (999), and access to a wide range of health information covering signs and symptoms to potential treatment options. The NHS services range from facility-based (e.g. cancer or emergency care) to community outreach or GP services. Many see the increasing integration and implementation of technology within the NHS structure and services as successful, at least in the primary care settings (Johnston, 2017; Pencheon, 2015; Waring, 2015; Waterson, 2014). The technological approach of NHS has included the use of web, app and phone-based consultation (voice, video and SMS); integrated and interoperable medical records; the empowerment and inclusion of patients via mass SMS and voice-based information dissemination through feedback loops; easier and faster access to access to appointments and prescriptions; and offering call centre-based management of queries and suggestions.

A recent analysis of the role of technology in advancing NHS services and ensuring patient access shows that it has not been the 'magic bullet' that it was assumed to be (Castle-Clarke, 2018). The integration of technology within the NHS can be broadly categorised into four areas: a. the use of genetic engineering and devising new and additional therapeutic options for subgroups, commonly known as *genomics and precision medicine;* b. remote care ensuring intervention and service provision at the earliest possible time; c. technology-supported self-care to empower patients for behavioural changes, early care seeking and adherence to treatment for better impact of therapeutic management; and d. use of data to learn and generate new research ideas to provide accurate, timely, equipped and effective diagnosis and therapeutic management (Castle-Clarke, 2018). Based on these technology innovations, NHS forecasted its future plan to serve more people and reach the previously unreached by ensuring: a. an easy online

access to urgent care, b. a dedicated call centre (111) to resolve healthcare without going to the Accident & Emergency (A&E) centre or GP, c. the implementation of a simple online-based appointment booking system, d. the availability of patients' Electronic Medical Records (EMR) to the appropriate service providers and e. by promoting increased use of app-based self-care (NHS England, 2017). Sophie Castle-Clarke explained in her report that while technology integration has improved the NHS's management and delivery of service, the progress has been rather slow. Patients expressed their concern about how the NHS managed patient records, especially when third parties were being involved. However it was also noted in the report that people have been found to be gradually embracing technology and getting comfortable with the current implementation of technology (Castle-Clarke, 2018).

From a people-centric perspective, decision-making is a major dimension for equitable access to health. In the context of eHealth services, the availability of accurate information plays a crucial role in healthcare-seeking, followed by peoples' ability to be able to interact with the browser to access the internet platform (where the information is hosted). In the UK, among the targeted groups, eHealth services focusing on providing accurate information are gaining in popularity. For example, a web-based alcohol reduction intervention called *Think-Aloud* was designed to provide personalised feedback to participants who were university students. A qualitative study of this intervention found it to be effective and helpful. Think-Aloud was eventually reported to be triggering cognitive engagement and related behavioural changes among the participants (Marley, Bekker, & Bewick, 2016).

The internet serves as a popular source of health information for decision-making among the populations of developed countries. This means that when it comes to using technology, citizens of developed countries have considerable sensorimotor and cognitive abilities to interact with devices like phones or computers (as discussed above). Perhaps this is why we are increasingly finding Google to be one of the popular means for health information and related decision-making among communities (Eysenbach, Powell, Kuss, & Sa, 2002; Kaicker, Debono, Dang, Buckley, & Thabane, 2010). However, the internet can be a mix of both accurate and inaccurate health information. Inaccurate health information can be misleading and sometimes harmful, e.g. becoming a victim of counterfeit drug or

being alarmingly late in seeking help from legitimate healthcare providers. A recent study reviewed available internet resources for decision-making about fertility preservation and the initiation of cancer treatment among UK women. Advice provided by these internet-based resources varied widely. While only few were found to be appropriate, the rest were could be considered misleading and confusing. The study embarked on formulating appropriate guidelines for the hosting of such information electronically and to help patients access appropriate and high-quality information related to their needs. It suggested five components for such guidelines (Mahmoodi et al., 2018):

a. Presenting future health problems related to the current illness,
b. Enabling people to understand health status across all disease-related complications by symptoms, cause, timeline, consequences, cure and management etc.,
c. Presenting various scenarios related to future complications by treatment options to help in making effective and informed decision,
d. helping people to become aware of the right time in the disease pathway to make decisions, in order to minimize disease impact and
e. presenting treatment related adverse effect(s) and a focused discussion on its risk and benefit in regard to the disease related complications.

The NHS has been particularly successful in applying this guidance and its website (https://www.nhs.uk/) hosts an extensive patient information system, which has become a major source of health-related decision-making both for patients and providers. In the last few years, the NHS has successfully transferred the entire primary care and a large part of secondary and tertiary care onto its electronic platform. The electronic health record (EHS) is now a major source of information for UK health providers and this has made it easier for people to access healthcare anywhere in the country. Also, the NHS website and its corresponding helpline is helping people to gain access to accurate and useful information, which has had an influence on reducing on waiting times, gaining appointments from home and in some cases, remote consultation and emergency care (Fraser & Wyatt, 2014; Johnson, Fraser, Wyatt, & Walley, 2014). This is a good example of how technology can improve access because it helps

in empowering people to make better decisions regarding care seeking and supports effective management as well as helping providers to deliver better services. Similarly, other developed countries like Australia and Germany are using technology for better access and improved service delivery (Department of Health, n.d.; Federal Ministry of Health, 2020). However, the health systems of LMICs have not been successful in improving access to healthcare by empowering people and involving healthcare providers for better and improved management of the health needs of their people.

In the changing context of health systems rapid technology growth, how do access to healthcare concepts help us? Given the global changes in hardware and software, how can we apply the conventional concepts of access? If we understand technology as a major disruptive force in development, the conventional understanding of health markets has changed, and has redefined the service providers, consumers and the mode of delivery. Because of these innovations and the use of technology, seeking digital health information and services is becoming an integral part of health care seeking. The NHS experience is thus a very important example of the access dimensions, especially in the context of eHealth and mHealth. This extends the general concept of availability of services to the point where people are aware of and able to access healthcare. As the health market is shifting towards a health knowledge economy, access to and use of technology for health is becoming a decisive factor in accessing health services. As a result, the concept of social exclusion and vulnerability is also changing. Groups with greater access to technology are becoming somewhat information rich and the rest are becoming information poor. In addition, groups who are socio-economically poor already have limited access to technology; thus they are being forced further down the vulnerability ladder and their access to health services becomes more and more restricted (Bloom, Berdou, Standing, Guo, & Labrique, 2017; Bloom, Henson, & Peters, 2014; Bloom, Standing, & Lloyd, 2008; Fatema Khatun et al., 2014).

Considering the discussion on access to health, Evans, Hsu, & Boerma (2013) have presented a more indicator-based simple framework: a. *physical accessibility* (good services that are within reasonable reach of everybody), b. *financial affordability* (people's ability to pay without financial hardship) and c. *acceptability* (people's willingness to seek services). In recognition of the context of technology growth,

information accessibility was later added to this framework. It is a human right to seek, receive and contribute health related information; *right to information* (WHO, 2015a). However, this four-point framework need to be contextualised by incorporating structural and population factors and, last but not least, people's experiences of illness and health.

In a context where there is rapid growth of technology and increasing efforts to adopt ICT as a development solution, ICT has a potential role to reduce disparities related to access to healthcare. But the task is to understand how the dimensions of the digital divide and access to health are complementing each other. Discussion in this and the previous section shows a way to critically assess the role of technology in addressing health disparity; and access to health in particular. As a generalised approach, we can use the discussion to explore how provision of ICT has been able to ensure: a. availability of health services, b financial affordability, c acceptable health services and d right to information. And we also have to understand how the growth of ICT and its adoption for health is interacting with structural and human factors in a society; i.e. how various policies and strategies have created an enabling environment for ICT to offer health solutions to people, and how ICT is influencing society's care seeking practices. Therefore, for this thesis, we need to explore the ICT landscape of Bangladesh to understand the growth of tech-based healthcare solutions and the related digital divide. This will help us to discuss the interaction between society and its inherent practices and digital healthcare provisions with through people-centric frame. In the next section, I will present the current landscape and use of digital means for accessing healthcare in Bangladesh.

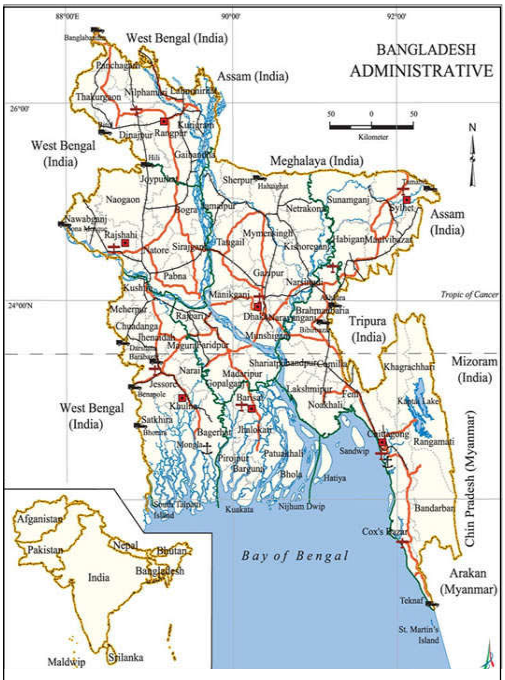


Figure 2.9 Administrative map of Bangladesh (Banglapedia, 2015)

2.3 Bangladesh: A Snapshot of Growth of Technology, Health Disparity and ICT and Health

Bangladesh is one of the most densely populated countries in the world with a population of 165 million. It is

surrounded by India, except for a little bit of Myanmar at the south-eastern corner and the Bay of Bengal to the south (figure 2.9). It has seven administrative divisions, 64 districts and 483 sub-districts (Banglapedia, 2015). Like many developing countries, Bangladesh is also struggling with a number of challenges including a dysfunctional political system, corruption and a lack of accountability, terrorism, natural calamities and climate change, and widespread disparities across various development indicators, such as social security etc. Despite this, Bangladesh is often referred to as a 'model' that has made remarkable progress in improving the lives of the poor in a short period of time. The current annual Gross National Income (GNI) has increased from $100 in 1971 to $1,480 in 2017. The poverty rate has declined from 44.2% in 1991 to 14.9% in 2016 (projected). Due to its continued economic growth, Bangladesh earned the status of lower middle-income country in 2014. Bangladesh also has remarkable achievements in female education, health, roads and transportation systems etc. (BBC, 2018; The Economist, 2012; World Bank, 2017).

As mentioned in the introduction, the context of my thesis is Bangladesh. I chose Bangladesh because of the ongoing rapid growth of ICT in the country. over the last decade or two. Many have described Bangladesh's successes as direct outcomes of the growth of digital platforms and its vigorous nationwide endorsement and adoption (Anir, 2017; Rahman, Abdullah, Haroon, & Tooheen, 2013). In addition, Bangladesh is a global leader in healthcare. Despite the country's health related achievements, there is evidence of marked access disparity. As a result, there is rapid adoption of technology in health. Therefore, Bangladesh makes an ideal context to study the impact of eHealth and mHealth in reducing access related health disparity. In the following subsections, I present the landscape of technology growth and the related digital divide, the state of health-related disparity and the eHealth and mHealth landscape in Bangladesh. I make an attempt to assess the influence of eHealth and mHealth on the country's access to health status.

2.3.1 Growth of ICT: Bangladesh Scenario

Bangladesh's ICT industry is entirely dominated by the mobile-cellular technology. The country is the fifth largest mobile market in the Asia-Pacific region, and the ninth globally. By the end of 2017,

there were 85 million unique subscribers (51%), with an average of 1.7 subscriber identity module (SIM) cards per subscribers, representing a connection penetration of 87% (total SIM connection). It is remarkable that within a decade, the country has achieved a subscriber penetration of 51% (2017) from 1% (2003) (Figure 2.10) (Rogers, 2018, p. 19). The industry is growing so fast that by 2015, it has contributed 6.2% of GDP, worth 12.7 billion USD. Bangladesh's journey towards such growth started in 1989 by issuing licenses to a Code-Division Multiple Access (CDMA) company called Pacific Bangladesh Telecom Limited, popularly known as 'CityCell.' From there, it took 13 years to reach one million connections and in 15 years, this rose to 85 million subscribers. The industry consists of mobile network operators, infrastructure service providers, retailers and distributors of mobile products and services, handset manufacturers and mobile content, application and service providers. At present there are three private and one state-owned service providers serving the population. By 2017, unique internet subscribers reached 21% (35 million). Right after that 4G was launched, which is now expected to reach half of all internet connections by 2025. Due to the availability of low cost devices in the market, smartphone penetration has reached about 31% (45 million) (Rogers, 2018). The current mobile-cellular market offers services through different packages, specially designed to attract different groups of subscribers based on their needs.

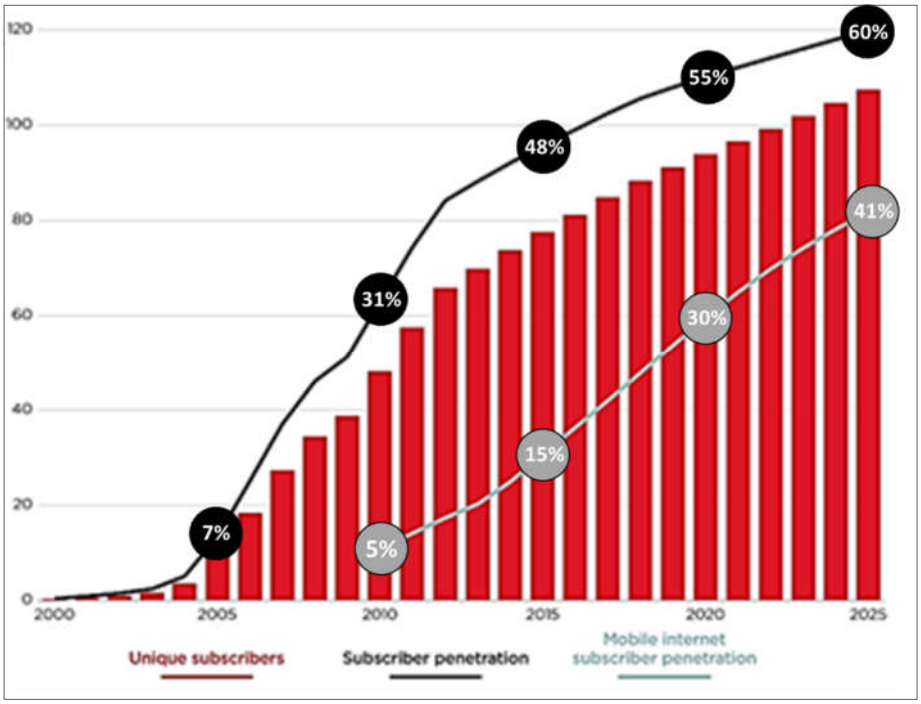


Figure 2.10 Trend in mobile subscriber dynamics in Bangladesh

In 2016, various packages offered by different mobile companies in the country can be broadly categorized into three: a. cheap deals on everything (talk time, data, SMS and MMS) for students and young adults, b. cheap deals on everyday use of mobile phone (talk time and SMS mostly) and c. heavy users with lots of talk times, data, SMS and MMS. The offers are explained below:

a. *Cheap deals on everything.* These offered an opportunity to use all kinds of services offered by a network provider at a cheaper rate. It was available to both prepaid and post-paid users and came in bundles valid for as short as one day to as long as 30 days. It cost a minimum Bangladesh Taka (BDT) five to maximum BDT 500. These bundles sometimes came with; 1. free internet if a certain volume of data was bought; i.e. two gigabytes (GB) free if four GB was purchased; 2. free SMS to the same network; and 3. free talk time if topped up for a certain volume of talk time; and minimum rate calls to friends and family (FnF) both within and outside their own network. Sometimes it also included cheap rates or free calls for a certain time period of the day (i.e. 12 am to 8 am). Looking at the marketing techniques, these offers primarily targeted young adults and students focusing on the need for social networking, chatting and affordability (low price). The table in Annexure 1 illustrates a few of these packages.
b. *Cheap deals on everyday use of mobile phone (talk time and SMS mostly).* The main assumption for this offer is that not everyone is interested in different kinds of services and their main purpose is to communicate with people. Keeping this in mind, these deals included talk time and/or SMS at a cheaper rate. Sometimes they included several FnF numbers and a validity period. They were called *smart packs* or *minute packs* and were available to both prepaid and post-paid users. Looking at their marketing materials, this type of offer was designed for people with limited financial capacity; people of all age groups and professions. The table in Annexure 2 illustrates a few of such packages.
c. *Heavy users with lots of everything.* these packages included everything in large volumes and were the most expensive. These were meant for people who needed to use their mobile phone frequently perhaps for professional services or business purposes. These packages came with longer validity

and were available to both prepaid and post-paid subscribers. The table in Annexure 3 illustrates some of these packages.

In recent years, Bangladesh has made remarkable progress, especially in sustaining an economic growth of 6% GDP per year and has halved an extreme poverty level. The country has also made considerable progress in improving a number of human development indicators including health, education etc. However, there are still about 40 million people living in poverty and 20 million in extreme poverty. There are still considerable food shortages and production gaps in the country. On top of this, there are the added perils of population growth, rapid and unplanned urbanization and natural disasters. To combat these challenges, the government of Bangladesh adopted a comprehensive development plan popularly known as *'vision 2021.'* This was proposed by the ruling party as an election manifesto prior to the general election in 2008. The vision was to transform Bangladesh into a middle-income country by 2021. And to do that, ICT was proposed as tool to eradicate poverty, establish good governance and ensure social equity (through quality education, healthcare and law enforcement for all) and prepare people for climate change. In the vision 2021, the ICT integration plan was called *Digital Bangladesh,* which is currently being implemented by a programme known as 'access to information' (A2I) under the direct supervision of the Prime Minister of Bangladesh. The main priorities of Digital Bangladesh are shown in Box 2.2. To steward the mandate of *Digital Bangladesh* and create an enabling environment, the government endorsed three policies: ICT Policy 2009, Right to Information Act 2009 and ICT Act 2009. With these policies, the main task of A2I is to ensure an improved quality of public service by increasing access and promoting decentralisation. To take this forward, A2I has trained about 200,000 civil servants, established about 4,500 Union Digital Centres, and has promoted thousands of entrepreneurs to help implement e-services at these centres (A2I, 2011, pp. 3–6; M. Rogers, 2018).

Box 2.2: Main outcomes of *Digital Bangladesh.*

1. Human resource development,
2. connecting citizens,
3. digital government for pro-poor service delivery e-administration platform for affordable and transparent e-services,
4. ICT in business; promoting access to markets by the disadvantaged, promotion of ICT businesses in the country and boosting ICT as export-oriented sector.

Given the wealth of literature on the growth of ICT, there are surprisingly few works demonstrating the presence of the digital divide in Bangladesh. However, there are a few confirming global evidence regarding a lack of access to ICT by various socio-demographic groups: men, younger people and richer and more educated groups have higher access compared to others. A survey of 4915 respondents in rural Bangladesh showed that mobile ownership is higher among men (69%) compared to women (34%). A greater proportion of men (39%) were aware of the use of mobile phones compared to women (27%) (Khatun et al., 2017). Similar divides were reported by others showing the influence of age, gender, education and income over the ownership of mobile phones (Alam, Alam, Mushtaq, Khatun, & Mamun, 2018; Zhou, Singh, & Kaushik, 2011). Analysis of a relatively old data showed that the trend of household ownership of mobile phone significantly increased from 30% to 56% between 2008 to 2011. The study identified a lack of, or fewer, years of education, unavailability of electricity and poorer socio-economic status (SES) as the main barriers for access to mobile phones. However, it also added that over time the impact of these barriers became less evident due to the universal availability and reduction in price of mobile phones (Tran et al., 2015).

Based on the current evidence, it is unmistakable that Bangladesh is experiencing a rapid growth in ICT, especially in mobile cellular technology. Over time it has gained major economic and political support and is showing much potential for safeguarding the wellbeing of the people of Bangladesh. During this review, I could not find the exact number of such tech-based development projects, but almost all the sectors in Bangladesh now have internet-based services (webpages or social network pages), as well as SMS based or call centre-based services. Some of them are providing services like cash transfers (eCommerce) while most of them are providing information.

However, considering the evidence of the digital divide, integration without much focus on the access disparity can result in further reasons for marginalisation and add to existing vulnerabilities. With such growth and political pressure, the question remains: can this become a major instrument to ensure health for all, in a context marked by access-related health disparity? In the next subsection, I will present the state of access to health in Bangladesh and then will come back to this point.

2.3.2 State of Health Disparity in Bangladesh

Bangladesh has made substantial progress both in demographic and health indicators in the last two decades. In spite of low public healthcare spending, a weak health system and pervasive poverty (Balabanova et al., 2013), there has been tremendous improvement in health related millennium development goals (MDG) 4 and 5. In respect of MDG 4 there has been a two-third reduction in child-mortality (from 133 in 1993-94 to 53 in 2011 per one thousand live births) and in respect of MDG 5, there has been a 40% reduction in maternal mortality ratio (MMR) (322 in 2001 to 194 in 2010 per hundred thousand live births) (Ahsan et al., 2017; NIPORT, MEASURE Evaluation, & Icddrb, 2012; NIPORT, Mitra and Associates, & ICF International, 2016). Besides MDG, the country has achieved almost replacement level total fertility rate (TFR) which is 2.3 (NIPORT, Mitra and Associates, & ICF International, 2013), more than 90% immunisation coverage (WHO, 2014b), increased life expectancy at birth from 60 years (1990) to 71 (2013) (World Bank, 2015), more than 90% coverage of vitamin A supplementation (VAS) among under-five children, elimination of polio and containment of HIV prevalence below 1% (WHO, 2014b; Wirth et al., 2017). However, these achievements do not apply to the whole country ubiquitously; not every region in the country has made satisfactory and similar progress, i.e. TFR varies between rural and urban areas and different regions of Bangladesh has different TFR: southwest and northern region has 1.9, north-western region has 2.1, southern region has 2.2, North-eastern has 2.9 and south-eastern has 2.5 births per woman (NIPORT et al., 2016). There are a number of health system issues that requires immediate attention and there is growing concern around prevailing disparities that are limiting access to and utilisation of quality healthcare (Ahmed, Hossain, Chowdhury, & Bhuiya, 2011; Chowdhury et al., 2013).

In the previous parts of this chapter, I discussed disparity related to access to healthcare. The discussion concluded with a four-point scale; a. physical accessibility (good services are within reasonable reach of everybody), b. financial affordability (people's ability to pay without financial hardship), c. acceptability (people's willingness to seek services) and d. right to information (right of the people to

seek, receive and contribute health related information) (Evans et al., 2013; WHO, 2015a). I will discuss the state of access to healthcare in Bangladesh using these dimensions.

Physical accessibility is about the availability of good health services. The availability of services can depend on many factors; for example: geographical accessibility, distribution of human resource for health (HRH), and whether available services meet the needs of the community. Bangladesh has made remarkable improvements to geographical accessibility in two respects: structure of the health system and the road transport network. Previously the public health system of Bangladesh was three-tiered following the administrative structure of the local government: primary at the base, secondary in the middle and tertiary at the top. Now it is a five-layered pyramid. The base is comprised of about 14,000 community clinics (CC) at ward level, followed by about 4,000 union health and family welfare centres (HFWC) and then 402 Upazila Health Complexes (UHC). These bottom three layers comprise the PHC of Bangladesh. In addition to the services under PHC, UHC is generally obligated to offer at least emergency caesarean sections (CS) as part of the emergency obstetric care (EmOC) in favourable situations and given the availability of human resources and logistics. Then the middle part of pyramid (the fourth layer) is secondary health care comprised of 64 district hospitals. The apex of the pyramid (fifth layer) is tertiary care formed of the medical colleges and post-graduate institutes. To make public health services available on people's doorsteps, in 2009 a CC was introduced for every 6000 of the population. This helped in improving the geographical accessibility (Mannan, 2013, pp. 27–28; MoHFW, 2016; WHO, 2017b). Analysis of two rounds (2001 and 2010) of Bangladesh Maternal Mortality Surveys (BMMSs) explained possible factors for the reduction in the MMR in Bangladesh. One of the major factors that contributed to this reduction is the improvement to transportation network in the country. The article reports that between 2001 and 2010, 19,000 km of dirt roads and 32,000 km of paved roads and 300 km of bridges were constructed. This outside health factor has resulted in increased access to Emergency Obstetric Care (EmOC) facilities (Arifeen et al., 2014). However, not all parts of health system are this well developed.

As mentioned earlier, the distribution of HRH is an important determinant of physical access to good quality health services. The country is haunted by a serious lack of qualified HRH. Currently there are about 64,434 doctors and 30,516 nurses with a doctor to nurse ratio of 1:0.4, which should be 1:3 according to WHO (Ahmed et al., 2015, p. 83). There are approximately five physicians and two nurses per 10,000 Bangladeshi. According to the World Health Organisation (WHO), the critical threshold for trained HRH is 23 (Ahmed et al., 2011; WHO, 2014a). Among the qualified HRH, there are twice as many doctors as nurses and these are doctors mostly clustered in the urban areas (Ahmed, Evans, Standing, & Mahmud, 2013; Ahmed et al., 2011). Another study reported that in a district hospital, among 40 posts of medical doctors, 13 were filled and only five of those were regularly available (Mannan, 2013, p. 69). This lack of trained HRH has resulted into the proliferation and predominance of informal healthcare providers (IHP). They are an assorted group of unqualified and unlicensed medical practitioners consisting of village doctors, drug vendors, traditional or spiritual healers and traditional birth attendants, and are the most preferred healthcare providers both in rural and urban Bangladesh (Ahmed et al., 2013; Mahmood, Iqbal, Hanifi, Wahed, & Bhuiya, 2010). Figure 2.11 schematically shows that the primary healthcare is largely dependent on the informal healthcare providers, and doctors and nurses are mostly concentrated in urban areas (secondary and tertiary care).

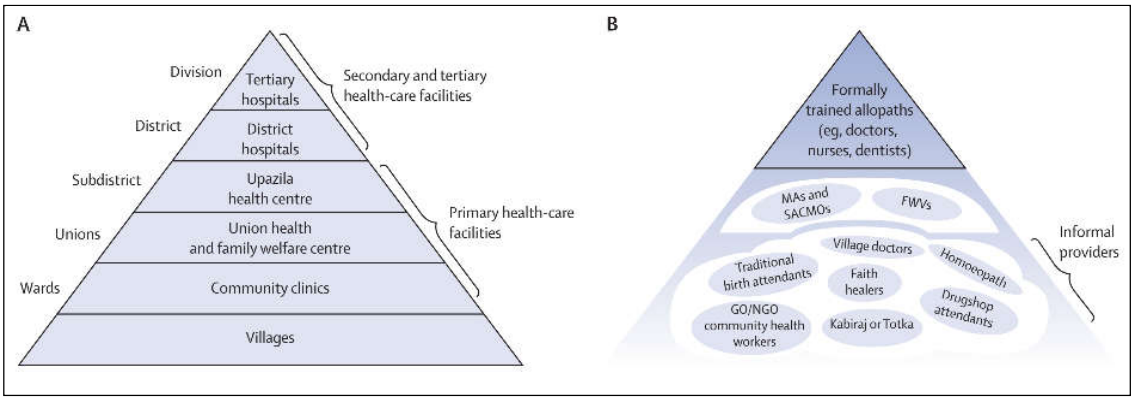


Figure 2.11 Hierarchical public-sector provision of services (A) and de-facto provision of services (B) in Bangladesh (Ahmed et al., 2013)

There are other socio-demographic barriers which restrict people's physical access to formal healthcare, i.e. geographic location, income disparity, gender related discrimination and age disparities etc. Evidence suggests that poverty and gender discrimination and related disadvantages have resulted in

restricting access to maternal and reproductive healthcare among Bangladeshi. When SES and sex is stratified by age, evidence suggests that below the age of 14 years, poor males suffers more from diseases compared to other groups (Walton & Schbley, 2013; Zere et al., 2013). Like many low and middle-income countries (LMIC), Bangladesh too is experiencing rapid and unregulated urbanisation, which has resulted in access-related health disparity between rural and urban Bangladesh. A national survey, conducted in 2012, reported that where the distribution of selected non-communicable diseases (NCD) was concerned i.e. high blood pressure, diabetes, asthma, heart disease etc., prevalence was much higher among urban Bangladesh than those in rural areas (BBS, 2013, pp. 22–23). The Bangladesh Urban Health Survey 2013 reported that one-third of urban people currently are living in slums and only 13% of them have access to improved sanitation (flushed to piped sewer/septic tank or ventilated pit). Even in the non-slum areas, access to such facilities is poor (50%). It also reported that only 2-4% urban dwellers receive essential new-born care and about 4-11% have home delivery attended by medically trained personnel. There is evidence of disparity within urban areas, too. Based on where people live, access to healthcare varies by socio-economic group. Urban poor (slum dwellers) have less access to Maternal and Neonatal Child Health (MNCH) care compared to non-slum dwellers. Fewer slum dwellers have a medically trained provider for antenatal care (ANC) available to them (54%), compared to the non-slum population (62%). While a majority (76% to 83%) of the non-slum population receives ANC, only half of the slum dwellers receive the same. In addition, only 29% of urban poor women are likely to receive at least four ANC compared to the non-slum women (58%). Also 37% of the urban slum women had delivery attended by medically trained staff, while that was the case for 68% for the non-slum women (NIPORT, MEASURE Evaluation, & Icddrb, 2013, pp. 8, 41–42).

The shortage of trained healthcare professionals and abundance of private and informal healthcare provision has led Bangladesh to: a. restricted access to quality healthcare for communities (Iqbal, Hanifi, & Wahed, 2009, p. 48) and b. increased out of pocket (OOP) healthcare expenditure for people. In 2012, the OOP expenditure for health was 64% of total healthcare expenditure (THE) ($4.1 billion), and was 93% of total private expenditure and is the highest in Asia; with India at 89.2% and

Nepal 79.9% (Adams et al., 2013; Ahmed et al., 2015, p. 54; Bangladesh Health Watch, 2012, p. 31; HEU, 2012, p. 11; Molla & Chi, 2017). In recent years the proportion of OOP within has increased to about 72% of current healthcare expenditure (estimated), in Bangladesh (WHO, 2017c). This indicates that the people of Bangladesh have less access to formal healthcare providers and that poorer socio-economic groups have even less, due to financial inability.

The last two parameters of access to healthcare are *acceptability* and *right to information*. I find both are far from being simple. Whilst reviewing the literature, I found that acceptability is usually conceptualised/measured by the following (either separately or in combination): expectation and satisfaction. And there are three broad categories of evidence on these two: a. scoping or exploratory studies of a community's demand/expectation regarding any health provision that is yet to be launched, b. experience of using a health service which is already being implemented and c. willingness to pay studies, showing a community's expectation regarding the financial attributes of a future or ongoing health provision. I also noticed that these studies made an attempt to understand people's expectation and satisfaction vertically, pertaining mostly to provision of healthcare and they do not represent the state of acceptability of healthcare provision in the country in general. Nor do these represent the huge private healthcare provision which is dominating the present care seeking practice in Bangladesh. The acceptability of current healthcare provision among the people in Bangladesh does not appear to be high. There have been numerous newspaper articles reporting violence against healthcare professionals. An article recently analysed these reports and suggested that there is a common notion among people (and in the media) that healthcare professionals are grossly negligent. People also think that the current medical practice in Bangladesh is largely deliberate malpractice and wrong treatment, as many healthcare professionals are susceptible to the influence of various pharmaceuticals, diagnostic centres and clinics for commercial and personal interests. The article explained that this has eventually led to numerous reported and unreported cases of violence against healthcare professionals across the country. The reported cases mostly concerned physical violence, while the unreported ones were said to be primarily psychological in nature, i.e. verbal abuse, threatening, bullying etc. This corroborates with global

incidences of health workplace violence. Unfortunately, there are not much published evidence on health workplace violence in Bangladesh. However, there are countless newspaper articles which can provide the context of violence against healthcare professionals in Bangladesh (Hasan, Hassan, Bulbul, Joarder, & Chisti, 2018). While the study was one of the first to point to this burden of violence, it failed to explain the root cause of this violence except for mentioning 'negligence' and 'malpractice.' Considering this article as the starting point and after assessing about 20 incidences reported by popular newspapers, I conclude that there is a deep distrust in the community regarding healthcare providers' practice. While Bangladesh has a well-structured public health system, uncontrolled growth of private healthcare and their monetary interests has led people to believe that measures taken by the healthcare professionals are driven by money. Therefore, whenever a patient is rushed to a hospital, any investigation ordered by the physician appears to the community as 'unnecessary.' Or if the patient is treated at the intensive care unit (ICU), people think it is a money-making effort rather than actual treatment. The situation often deteriorates in the case of the death of a patient. Such incidences are almost always thought to be caused by the incompetence of the doctor. It is rather difficult for me to explain what is right and what is wrong (because of the dearth of evidence), but the distrust is there. This is clearly an indication of a lack of acceptability of the current system of healthcare provision in the country.

As I have mentioned earlier, *right to information* is also complicated. It is one of the cornerstones of the modern world. Often democracy and the right to information (also called freedom of/to information) are used synonymously and I find these complementary. As with *acceptability,* I could not find relevant literature in the context of Bangladesh. Nonetheless, health is a constitutional right in Bangladesh, and public facilities are the main healthcare providers in the country. Yet earlier we have seen people are reliant on the private sector. Considering such pluralism in the country, having the correct information is the means to avail oneself of good healthcare. Therefore, the right to information plays a very important role in access related health disparity and is related to the other three dimensions. Thus, it has been an important part of health policies and strategies in the country. There has been government legislation to enforce displaying info-boards in health facilities showing available services, service hours

and price (if relevant) at the health facilities. However, there is not enough evidence regarding how much of this has been effectively practised. In regard to access to health-related information, short drama and/or adverts on television or radio, i.e. HIV campaigns, primary health care provision etc. have been the most common sources for a long time. In addition, there are signs and billboards displaying health messages. Recently, health call centres have been emerging as the new means to access health information. However, evidence regarding healthcare-seeking suggests that social networks and communities are still the predominant sources of information; village doctors are the first preference as healthcare providers for rural and poor people. Based on my experience and observation as a medical doctor and as a health system researcher, I believe although right to health information is largely acknowledged, provision of authentic sources of health information is still limited for the people of Bangladesh. Often a lack of knowledge about the direct and indirect cost of healthcare can be the main reason for delays in healthcare-seeking.

Considering the discussion here, I find that access to healthcare is a major challenge for the health system of Bangladesh. This further increases the importance of my thesis by providing the rationale. By demonstrating the equity implications of eHealth, my thesis will be able to contribute to the discussion on the potential of technology in reducing these access barriers. In the next section, I will present the landscape of eHealth and mHealth in Bangladesh and critically reflect on how much it has been able to contribute in reducing access related health disparity in the country.

2.3.3 ICT for Health: the eHealth and mHealth Landscape of Bangladesh

Integration of technology in Bangladesh's health system is a product of the ongoing fight to ensure health for everyone. To ensure access to healthcare, Bangladesh has prioritised UHC in 2011. It envisions 'equity of access' to essential health services (promotive, preventive, curative and rehabilitative) without financial hardship by the year 2032. To take this forward, the first 'Healthcare Financing Strategy 2012-2032' was devised in 2012 (Bangladesh Health Watch, 2012; HEU, 2012, p. 12; Huda, Khan, Ahsan, Jamil, & Arifeen, 2014). Considering the challenges to ensure 'equity of access' and the necessary capacity in Bangladesh's health system, a Lancet series entitled 'Bangladesh: Innovation for Universal Health

Coverage' proposed a five-point reform agenda: 1. Developing a national human resources policy and action plan, 2. Establishing a national insurance system, 3. Building an interoperable electronic health information system, 4. Strengthening the capacity of the Ministry of Health and Family Welfare and 5. Creating a supra-ministerial council on health. For better transparency and extension of coverage, agenda point three placed an emphasis on the use of technology for collection, compilation and sharing of information on service provision and individual information for appropriate resource allocation and disease management (Adams et al., 2013). This further justifies why the discussion on how technology in addressing health disparities in Bangladesh is so important and relevant.

Providing electronic services to reduce social inequity in accessing healthcare is one of the priorities for digital health, which falls under the third outcome (Box 2.2). The National ICT Policy of Bangladesh outlines four areas for healthcare to be delivered through electronic means: a. improved management of the healthcare delivery system(s), b. ensuring quality healthcare, c. improved awareness of and access to healthcare by the community and d. enhancement of the capacity of the National Health Service Delivery System (MoSICT, 2009). With such a policy backdrop, government, non-governmental organisation (NGO) and private initiated eHealth and mHealth provisions have proliferated rapidly in the country (Ahmed et al., 2014a; 2014b; DGHS, 2012; WHO, 2011b). In the next subsection, the eHealth and mHealth landscape of Bangladesh has been presented.

As mentioned earlier, Bangladesh has four mobile-cellular operators; *GrameenPhone, Banglalink, Robi* and *Teletalk,* who altogether cover about 95% of the country. There is a steady rise in household ownership of mobile phones. Public health surveys have reported that over a period of three years (2008 to 2011), the household ownership of at least one working mobile phone has almost doubled (from 30% to 56%). Currently about 81% households in Bangladesh own mobile phones (Ahmed et al., 2014a; BTRC, 2018; S. M. S. Islam et al., 2015; Khatun et al., 2014b; Paina et al., 2017; Waldman et al., 2018). Considering such high mobile phone coverage, technology has gained considerable attention as a potential tool for healthcare delivery, popularly known as electronic health (eHealth) and mobile health (mHealth) initiatives.

The World Health Organization (WHO) explains eHealth as spectrum of technologies including computers, telephony and wireless communications providing access to healthcare, and mHealth is a subset of eHealth that refers to the same via mobile phones. Bangladesh already has more than a decade of experience in testing and implementing such electronic healthcare initiatives. Examples include raising awareness regarding maternal health, drug and alcohol abuse, smoking cessation and HIV/AIDS. A scoping study conducted in 2012 reported 26 eHealth and mHealth initiatives in Bangladesh. It was later revised by an United States Agency for International Development (USAID) funded project called Bangladesh Knowledge Management Initiative (BKMI) under the global Knowledge for Health (K4Health) project implemented by Johns Hopkins Bloomberg School of Public Health Center for Communication Programs (JHUCCP) and listed 42 such initiatives (Ahmed et al., 2014b; 2014b; BKMI, 2014; ITU, 2014). Three types of entities are implementing eHealth services in Bangladesh: public (Government of Bangladesh), private for profit, i.e. private hospitals, telecommunication companies etc. and not for profit NGOs (Ahmed et al., 2014a). In terms of the operating platform/medium, these initiatives can be grouped into three categories: browser and/or app based online platforms (either on laptop/Personal Computer (PC) and/or mobile), short messaging service (SMS) and direct voice calling (call centre based telemedicine services mostly) (Ahmed et al., 2014a; 2014b; WHO, 2011b).

However, irrespective of the growth of eHealth initiatives in Bangladesh, there is evidence of low awareness about the availability of these services and presence of digital divide. A household survey of rural Bangladesh conducted during 2012-13 reported that about 31% of rural Bangladeshis reported being aware of eHealth and men were more aware (39%) compared to women (26%). It also reported that men, younger age-groups, and educated and richer households tend to have more knowledge regarding mHealth and eHealth compared to women, people aged 50 or more, or people who had no education and poorer households (Khatun et al., 2014).

The target population of eHealth initiatives in Bangladesh range from service providers to various population groups (socio-demographic characteristics). Among the 42 initiatives reported by BKMI, 13 targeted community-level health workers for activities such as counselling using a netbook, data entry for

community health statistics like pregnancy and births and managing and reporting related to drug inventory. Health supervisors and managers were targeted in 13 initiatives. Higher-level government officials and healthcare providers were targeted in seven projects. Some initiatives targeted various socio-demographic groups: rural population in three initiatives, women and children in five initiatives and the gatekeepers of households (husbands and mothers-in-law) in two initiatives (Figure 2.12) (BKMI, 2014). Therefore, the eHealth and mHealth initiatives in Bangladesh is largely focused on maternal, neonatal and child health and target population are either the relevant community groups or service providers. The eHealth services provided by the telecommunication companies (mobile phone) and some private

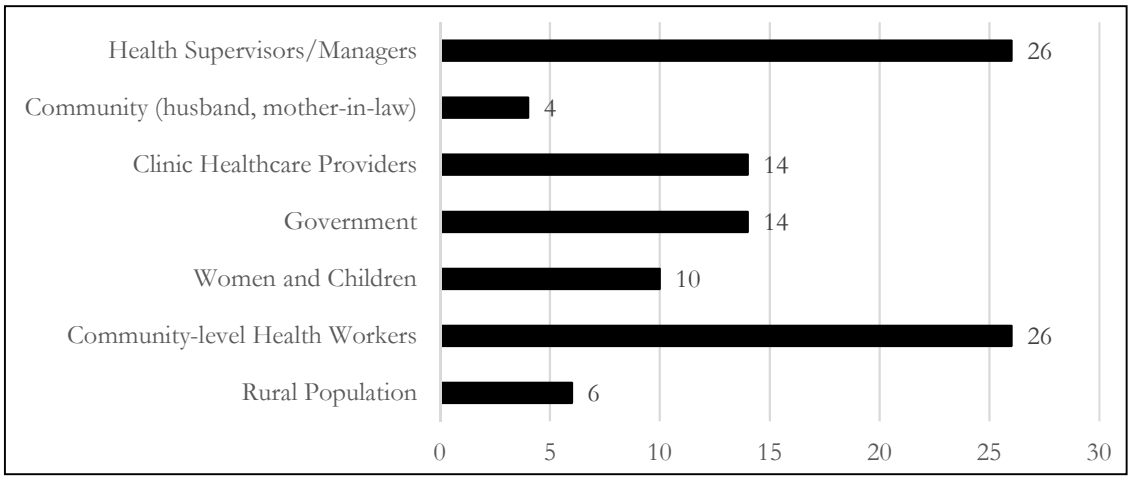


Figure 2.12 Distribution (%) of audience groups of eHealth activities in Bangladesh (N=42) (BKMI, 2014)

hospitals are however focused on general health and sociodemographic groups.

The Bangladesh is one of the LMICs who have endorsed and currently in the process of implementing ICT solutions/tools to improve population health outcomes and the performance of the health system. As mentioned in the introduction, in line with the current mandate of *Digital Bangladesh* under 'Vision 2021', the Ministry of Health and Family Welfare (MoHFW) is now implementing eHealth project(s) in light of the country's current ICT policy. These eHealth-related public activities can be divided into three groups: a. MoHFW has started to devise a regulatory framework for the country in collaboration with the development partners, b. Establishing an infrastructure to support the ongoing eHealth activities. Aiming to create a paperless information system, Directorate General of Health Services (DGHS) has set up a secure, robust and *'never-sleep'* data centre with protection against hacking,

fire, humidity, power failures and other technical issues (back-up system). At the peripheral level, DGHS has provided equipment for the seamless collection and sharing of information by the community and hospital health staff, And c. implementing call centre and SMS based healthcare delivery systems to improve and ensure access by all (Afroz, 2012; Ahmed et al., 2014a; Ahmed et al., 2014b; Ansari, 2010; DGHS, 2012). Annexure 4 lists the initiatives in eHealth in Bangladesh (BKMI, 2014).

Based on the landscape, Bangladesh can be a fertile ground for eHealth. It has the potential to reduce access related disparity and thereby ensure people's health related wellbeing for three reasons: a. growth of ICT – 87% of Bangladesh is covered based on SIM penetration; almost the entire country is covered by mobile-cellular networks and there is a huge base of household ownership (80%), b. ICT as a change agent for development is politically acknowledged (Digital Bangladesh) and c. there is rapid growth in eHealth and mHealth initiatives – at least 42 public, private and NGO led initiatives were reported in 2014. In the next section, I will critically discuss this supposed potential of eHealth in ensuring access to healthcare.

2.4 eHealth and mHealth in Bangladesh: Critical Reflection

A *bottom-up* approach or perspective can help in understanding the effectiveness of a health system, revealing the state of access to health in a country. It begins with the healthcare needs of the people; it can be someone complaining about one's health related ailments (expressed illness) or various preventive or promotive health programs designed to serve a population. The use of healthcare is also a popular proxy for understanding access through a *bottom up* approach. Considering this, although Bangladesh has a growing base of eHealth services and high ownership of mobile phones, use of technology to access healthcare and information has been reported to be very low. A survey among rural Bangladeshi reported that most of the households (>80%) owned mobile phones; however, only 31% of mobile phone owners were aware of eHealth and mHealth services and of people who owned mobile phones, only 2% of them had used them to access healthcare (Khatun et al., 2014). Here healthcare

largely refers to a wide range of health information accessed/received through SMS, direct (or recorded) voice call and internet depending on people's need. During 2012-13, a survey of rural Bangladeshi who sought healthcare in a two week period revealed that only 2% reported using mHealth services (Khatun et al., 2015). Bangladesh also has a marked digital divide which can be seen in the use of eHealth as well. As shown in the previous section, certain population groups (i.e. men, the more educated, as well as younger and richer socio-economic groups) are more likely to own mobile phones and are knowledgeable and aware of eHealth and mHealth services compared to women (Khatun et al., 2015; Khatun et al., 2017).

A survey of 4915 respondents was conducted between November 2012 to April 2013 to understand whether rural Bangladeshi are prepared to adopt mHealth or not. The study showed that about 50% were aware of SMS (sending and receiving only), 37% could read SMS generally and 5% had used the internet. In addition, the study also reported that there is a lack of trained human resources who can design and implement eHealth projects (Khatun et al., 2015). One of the popular mHealth intervention called *Aponjon,* the Bangladesh arm of *MAMA*[3], was designed to help pregnant women, recent mothers and their families through behaviour change through communication messages sent via mobile phones. It was implemented by a social entrepreneur in Bangladesh called *Dnet*. While there were improvements in the number of facility deliveries, immediate breast feeding, and delayed bathing of the baby, exposure to *Aponjon* messages was found 'not significant for the improvement.' However, the study concluded that such interventions haves potential for improving access to maternal and childcare in Bangladesh (Alam, D'este, Banwell, & Lokuge, 2017). I was involved in designing and implementing a *Skype* based health call centre in rural Bangladesh to provide primary healthcare for the general population. There were two sets of service providers involved, one at the rural end and another at the central end. When a patient seemed to have a complicated health issue, the rural end used to call the

[3] MAMA is Mobile Alliance for Maternal Action, a SMS and audio stage-based health messages system targeted to support mothers during pregnancy and with childcare from birth to age three (https://www.mhealthknowledge.org/resources/mobile-alliance-maternal-action).

	1980	1985	1990	1995	2000	2005	2010	2011	2012	2013	2014	2015
BCG		2	86	93	94	97	98	99	98	98	98	98
DTP3		2	69	69	82	93	94	96	94	94	94	94
Pol3		2	69	69	83	94	94	96	94	94	94	94
MCV		1	65	79	74	88	88	93	88	88	88	88

Figure 2.13 National immunisation coverage, 1980–2015

central call centre doctors and accordingly consultation was provided. The project never became popular among the local people, although everyone expressed their interest in being part of such initiative.

Among various eHealth initiatives, mobile phone-based interventions have been the most popular so far. A quasi-experimental (pre-post) study of rural (hard to reach) and urban (street dwellers) areas in Bangladesh reported that a mHealth intervention called *mTikka* has improved immunisation coverage among children age 0–11 months. The study was conducted between April 2013 to March 2014. It reported that in both urban and rural areas, the vaccination coverage was increased in the intervention area compared to the control. *mTikka* is an android-based app which included: a. smart phone-based registration of pregnant women, b. SMS notifications of birth by the mothers, c. SMS reminders of vaccination to mothers and health workers and d. smartphone and web-based supervision. The app was developed and implemented jointly by the mPower Social Enterprises Ltd, (a private organization based in Dhaka, Bangladesh) Department of Management Information System (MIS) at the MoHFW, GoB and the Johns Hopkins School of Public Health (JHSPH) (Uddin et al., 2016). The project later won the best innovation health care award in 2018 (mPower, 2018). While the *mTikka* is an excellent initiative and has a strong public-private partnership, it is hard to explain its success (although claimed). Bangladesh, being one of the global leaders in public health, initiated its vaccination project in 1979 as the Expanded Program for Immunization (EPI) and current coverage has reached over 90% (Figure 2.13). Together with hundreds of health NGOs and private providers, the Government of Bangladesh is

the primary implementer of EPI. We must remember that such excellent immunisation coverage is the achievement of decades-long motivation, collaboration and implementation (WHO, 2016b). Any study of EPI will face the challenge of adjusting for the impact of other interventions in order to separate out a single one. These tech-based health initiatives clearly show that Bangladesh is actively investing into leveraging technology to improve access to healthcare and to capitalise on the growth of telecommunication market. While these initiatives differ in their target population, mode of delivery or content, the role of technology in improving access is beyond further critical consideration.

A recent study of the use of eHealth services in Chakaria, a rural sub-district of Bangladesh, asked, 'how ready is the rural community for mHealth?' (Khatun et al., 2015). Its analysis was based on a conceptual model for mHealth readiness (Figure 2.14) which identified three dimensions: technological readiness (technological skill and access), motivational readiness (perception of, trust in and attitude towards mHealth services) and human resources (socio-demographic descriptors and awareness). The study concluded that while people have a degree of technological readiness (i.e. they can use a phone and can access available mHealth), they are not as well equipped in terms of human resources and there is also a divide issue regarding technological readiness (Khatun et al., 2015). The value of this approach can

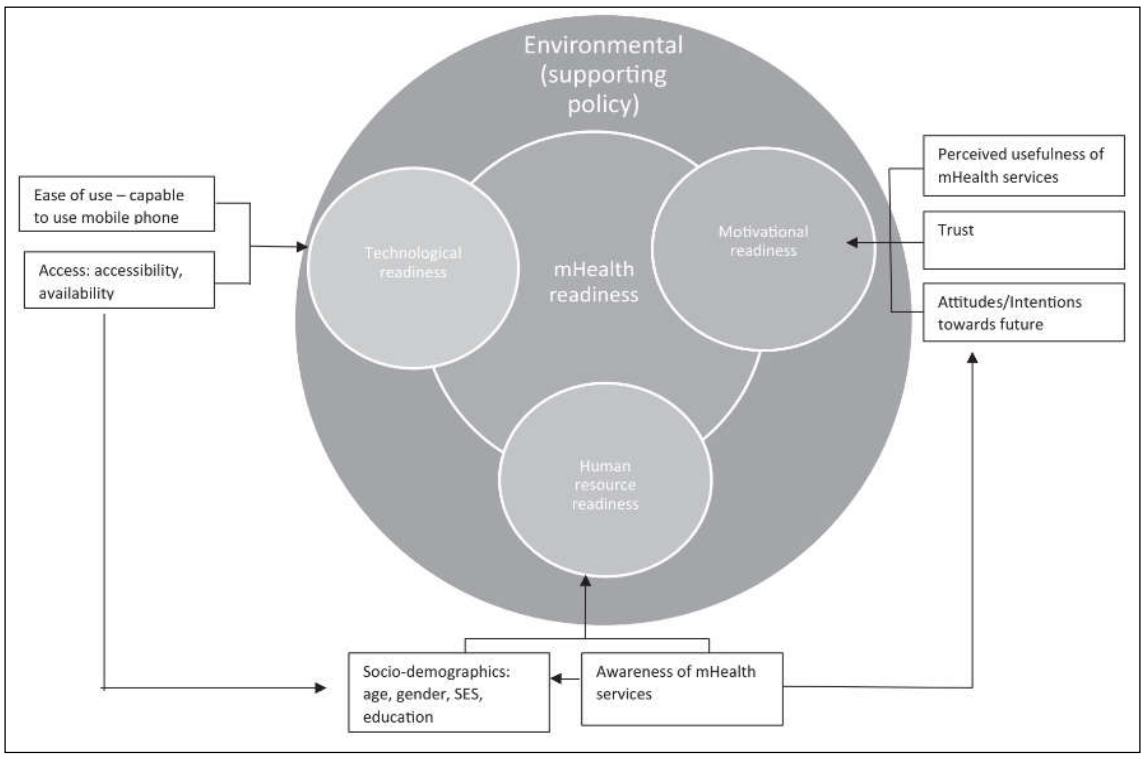


Figure 2.14 Conceptual Model for mHealth Readiness (Khatun et al., 2015)

be criticised as it contains untapped dimensions and domains. Firstly, the framework begins with the assumption that mHealth is beneficial and asks whether people are ready to realise the benefits of mHealth or not. Then it leaves the motivational issues unexplored. For example, the study reported that 17% of the participants mentioned that they did not trust mHealth services, which is probably one of the reasons for its non-use. But the questions concerning why they do not trust it, or what would have helped them to trust mHealth services, are left unanswered. This approach also overlooks the importance of people's perceptions of health and related healthcare-seeking, and how mHealth is translated within their worldviews. Therefore, the framework applied by Khatun et.al., represents another example of *technocentricity* in the domain of eHealth research, as it begins with the concept of generic technological readiness and the assumption that technology is suitable for meeting people's need for healthcare and information.

Does this mean that technology has failed to change people's lives in Bangladesh? While the critical analysis of technology to improve health system performance and peoples' health outcomes appear to be unconnected, frustrating and to some extent sceptical of its potential, there are examples of other *eDevelopment* projects in Bangladesh which are showing tremendous success and have excellent coverage and acceptability among people. One of such is Bangladesh's adoption of *mPESA* (mobile wallet) called *BKash*[4]. It is one of the most popular *peer-to-peer* FinTech- (financial technology) based banking services in Bangladesh. Eventually, *BKash* has become the cornerstone of digital financial inclusion services in the country. But what about eHealth and mHealth? Based on the review of existing literatures, I found that eHealth enthusiasts have a somewhat linear understanding of access and the potential of eHealth: 'if people have a mobile phone and if there are applications/websites in place, sending a text message (SMS) to the users can initiate behaviour change of the users which results in improved health outcomes' (Figure 2.15) (Jo, Labrique, Lefevre, Mehl, & Pfaff, 2014). And to ensure that, often these interventions involve intermediaries, the so-called knowledge broker, to make

[4] BKash is a mobile wallet which is implemented by BRAC Bank in Bangladesh. It has been a major initiative in protecting people, especially in rural Bangladesh, from financial exclusion due to banking related hindrances (https://www.bkash.com/).

communities aware and help them to access services through their phones or other electronic devices. These could include community health workers (CHWs) in the case of *mTikka* and *Infolady;* household workers in *Aponjon* to help pregnant mothers and their support network, or other doctors and I in our *Skype* intervention, to make people aware and utilise respective health services.

However, access to healthcare and related seeking behaviour is anything but linear and is a complex interaction between personal and social perceptions and practices (human factors). Despite high subscription rates and success in other sectors, the main reason for the low use of technology to access healthcare is in my opinion perhaps the poor conceptualisation of these human factors within the design of eHealth initiatives. As a result, people have failed to see the utility of eHealth services over the conventional system of accessing healthcare, even if the latter is often unsatisfactory, cumbersome, confusing and sometimes proving to be a financial catastrophe for some population groups. In addition, there is evidence of a digital divide. Therefore, without proper conceptualisation and understanding of community perception and practices, the implementation of eHealth services can increase access related health disparity, making people further excluded and vulnerable.

In this chapter, I have discussed both achievements and disparities in technology and health, separately. Based on the review, I believe the world is at a point where ICT growth is often depicted as increased access. It is assumed that a mobile phone is the key to wellbeing if it comes with development solutions. But perhaps increased access *to what, by whom* and *why* is missing. I believe that ICT has the potential to change people's lives, increase access to healthcare and reduce health disparity in resource-poor settings. However, I do not believe it is as linear as it is shown in Figure 2.15. I believe there are many human and contextual assumptions and conditions within the arrows linking various stages. And the ongoing effort towards integrating ICT into health to address access related disparity is lacking on this front. This thesis thus intends to explain that the generic concept of access to technology is not enough to explain its use for specific purposes like health information seeking and access to health services. People need to see the value in doing something that will contribute to what they consider as wellbeing. Therefore, it is important to understand that the use of eHealth depends on whether people

deem it fit to be used for accessing health-related information and services, when they are in need of healthcare. In the next chapter, I will present a conceptual framework in the light of relevant theories. This will help us to understand these *bottom up* factors within eHealth and explain its equity implications in regard to the existing access disparity in Bangladesh and similar contexts.

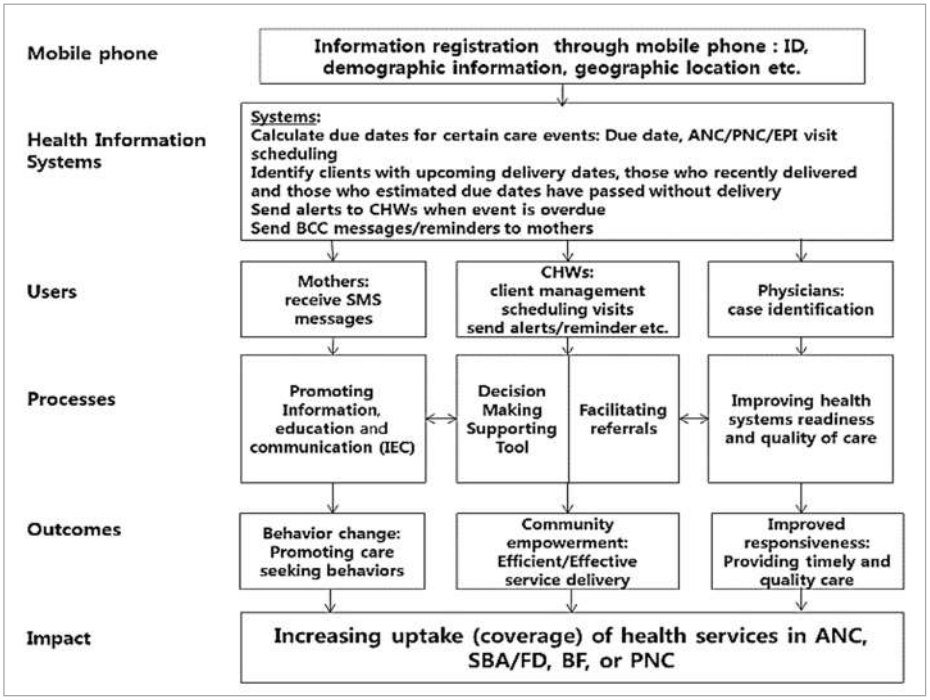


Figure 2.15 mHealth Service Coverage Increase Impact Model (Jo et al., 2014)

Chapter 3 | Conceptual Framework to Understand Equity Implications of eHealth in Bangladesh

One of the major challenges of questioning the use of ICT by people, or access to ICT, is probably making people ill at ease, especially the tech enthusiasts for whom growth and ownership of devices is synonymous with access or use. During the writing of this thesis, I have faced formal and informal criticism several times during discussions when stating that there is a human dimension of ICT use which can result into failure of ICT4D initiatives which is not yet well studied. Growth and ownership are probably the first steps in shaping ICT as a potential tool to ensure people's wellbeing and in this case good health. This is certainly not scepticism towards ICT's potential, rather, it is a call towards not wasting ICTs potential as a change agent with overenthusiasm, leading to imposition over social perspectives and practices. As explained before, due to lack of conceptualisation, such *bottom up* perspectives have always been poorly portrayed within the discourse of ICT4D. eHealth is no exception to that. In this chapter, I will discuss the theoretical underpinning of the *bottom up* perspective on ICT and present a possible conceptual framework to study the equity implications of eHealth regarding access to healthcare. First and foremost, understanding the equity implication of eHealth is like any innovation: its uptake (or use) is primarily socio-demographic class dependant: subject to age, sex, education and income. The theory of DOI, as explained earlier, suggests that in the context of rapidly spreading technology and increasing availability of eHealth initiatives, the information about these initiatives may not be reaching people. Or possibly, people have the information, but due to socio-demographic barriers, individual and group characteristics and/or a country's larger socio-political or policy environment, they are unable to access and use these platforms. One simple explanation to this is that people from other groups (who are not using eHealth services) are unable to see the positive impact of eHealth in their lives. Or in other words, they are not able to realise the value of ICT in accessing healthcare when they have health needs or quality of life issues. However, the question remains, what makes people use eHealth to access healthcare? Or what helps people to realise the potential of eHealth in accessing healthcare? The theory of DOI is useful in explaining the process of uptake but it fails to provide an inquiry framework to interpret the human

factors specific to health. Also, we must remember that the low use of eHealth does not mean that all ICT development initiatives have failed to attract people, i.e. *BKash* is a very popular mobile wallet initiative in Bangladesh. Therefore, to devise a *bottom up* conceptual framework for eHealth ensuring access to healthcare, it is necessary to explain the dimensions that make people to see the importance of ICT for their healthcare need. A popular *bottom up* development philosophy is the 'capability approach' by *Amartya Sen.* It explains the philosophical accounts of wellbeing and how it is related individual freedom, functioning and capabilities. It has been widely accepted by many to understand the human factors relevant to development gain. In the next section, I explain how this can be important to understand people's perspective on eHealth for accessing healthcare.

3.1 Brief Review of Capability Approach by Amartya Sen

We have briefly discussed the recent development paradigm that the global emphasis on income and economic growth is essentially a *top down* conceptualisation of human development (Kleine, 2009). In an effort to make it *bottom up,* Amartya Sen has argued in his book 'Development as Freedom' that development should be understood and analysed based on how people wish to live a life that they have reasons to value (Sen, 1999a). This is a departure from the previous way of thinking that development means being well-off (economic development) to meaning wellbeing. This makes the viewpoint more people centric. Thus, efforts to expand people's freedom to choose the life they value and remove related hindrances, is collectively called development. Sen concludes that freedom cannot be about economic factors (freedom to enter into the marketplace) and political factors (freedom to vote) only; rather, true freedom should also consider liberty to access social services, i.e. healthcare, sanitation and nutrition etc. (Miletzki & Broten, 2017; Sen, 1999a; 1999b). Having explained that, Sen also discusses the potential hindrances which he called 'unfreedoms.' According to Sen:

> 'Development requires the removal of major sources of unfreedom: poverty as well as tyranny, poor economic opportunities as well as systematic social deprivation, neglect of public facilities as well as intolerance or overactivity of repressive states' (Miletzki & Broten, 2017, p. 34; Sen, 1999a).

Sen later extended his argument around freedom beyond the economic angle to elaborate an evaluation approach to assess the level of development in a society. His book 'Development as Freedom' is the collection of lectures at the World Bank where he explains that wellbeing is a cumulative outcome of people's capabilities and agency, which can be critical in assessing the progress and state of development in a society. It is popularly known as the *Capability Approach* (CA) (Miletzki & Broten, 2017; Sen, 1999a). It has become very popular in a short period of time because of its use in explaining the pathway of how resource(s) can enable an individual (or the community) to achieve a goal that they may value. Sen explains that 'various things a person may value doing or being' are called *functionings* and 'the alternative combinations of *functionings* that are feasible for one to achieve' are called *capabilities*. In many cases, *functionings* can be an already achieved element of an someone's wellbeing (i.e. levels of health, education etc.). And the ability to be able to do what one values or has reason to value is called *agency* (Sen, 1999a; Sen, 1985, p. 203) (Faith, 2016; Roberts, 2015). For instance, Mr. X wants to go from one place to another for any purpose, without any difficulties. According to Sen's philosophy, this is a state of wellbeing for Mr. X as he values this as a personal freedom; within the traditional economic approach, this is called *utility*. One way to achieve this can be by riding a bicycle. Considering bicycle as a resource, Mr. X must learn to ride a bicycle and then he will achieve his personal freedom to go from one place to another. According to CA, the ability to ride bicycle is called a *functionings* and the ways to learn how to ride are called *capabilities*.

CA also recognises that personal (or group) *functionings* do not always refer to the *capabilities* or opportunities that are at an individual or group's disposal. Sen explains this using the example of two starving people. One person is starving because of religious reasons (religious fast), having the capability of being fed or buying food whenever he chooses to, and the second person is starving due to poverty and lacks the capability of being nourished. In the US context, Sen describes that getting admitted to a university does not mean that opportunities are the same for all students, because of racial and/or ethnic differences. And when it comes to agency-related freedom, it is also important to understand that the ability to act towards a wellbeing goal can be influenced by one's individual, social or demographic

characteristics *(human agency)* as well as by broader factors such as policy, political state, organisational provisions and views etc. *(external agency)* (Miletzki & Broten, 2017; Roberts, 2015; Sen, 1999a; Sen, 1985, p. 203) (Roberts, 2015).

It is also important to understand that capabilities and rights are not identical, but rather interdependent; capabilities enable people to practise their rights (Sen, 2005). By challenging the conventional utilitarian approach to conceptualising development, CA helps us to consider people's backgrounds and experiences and how they relates to their decisions and expectations (Nussbaum, 2000). Thus, because of its broad dimension, CA primarily being an evaluation approach, it has been widely used in policy and academia as a normative framework. Examples include the UN's adoption of HDI instead of Gross Domestic Products (GDP) calculations and the UK's Equality Measurement Framework by the Equality and Human Rights Commission etc. (Faith, 2016; Miletzki & Broten, 2017; Sen, 1999a; Sen, 1999b). However, there are considerable criticisms of CA, as well.

Although CA was primarily developed as an evaluation approach, it is heavily dependent on the pluralism of reason to value and considers the individual as the unit of analysis. Thus, it is very difficult to apply CA as a quantitative evaluation method. This is due to two central arguments of CA: a. the most important functioning is very subjective, and thus may vary among people and b. quantitative measures look for generalisation while CA is inherently focused on an individual's preferences and practices. Because of these challenges, CA is often characterized as too broad and vague to be evaluated. As a result it is very hard to operationalise CA (Alexander, 2008; Roemer, 1998; Sugden, 1993). Others have found CA to be very difficult to operationalise as well (Comim, Qizilbash, & Alkire, 2008; Deneulin & Shahani, 2009; Qizilbash & Clark, 2005; Zheng, 2009). However, being broad and vague also makes CA useful for exploring development concepts from a human perspective. While the operationalisation is difficult from a quantitative paradigm, it can be an ideal approach for more complex methods like system and qualitative research (Robeyns, 2000, p. 29). Considering this as a strength of using CA, it can be the ideal theoretical foundation for a bottom up approach to understanding the equity implications of eHealth in addressing access related health disparity.

Another criticism suggests that CA emphasises wellbeing, whilst failing to discuss agency with equal importance; i.e. how agency is created, what its constituents are etc. (Roberts, 2015; Robeyns, 2003; Zheng & Stahl, 2011). Sen explains agency as the ability to be able to do what one values or has reason to value. Rather than discussing the constituents or how it is developed, Sen has viewed agency as *human* and *external* (as mentioned above). In relation to this, Sen mentions *conversion factors,* which represent the relationship between resources and *functionings;* the degree to which one can transform a resource into a *functioning* (Nambiar, 2013; Sen, 1992). While in many ways both *agency* and *conversion factors* are the same, the latter is more inclusive of explaining the alternate pathways to achieve a specific *functioning* and wellbeing in relation to resources, capabilities, functionings and wellbeing. Or in other words, *conversion factors* are the critical form of agency which can be used in a more measurable way to understand the 'unfreedoms' which restrict a person or a group from reaching a state of happiness/wellbeing using available resources.

Based on the discussion above, CA is a complex philosophical underpinning for understanding the impact of development initiatives from a community's perspective. We have already discussed that this complexity makes it difficult to operationalise. In the next section, I will discuss a framework that has made an attempt to operationalise CA, called the Choice Framework. It demonstrates the use of CA to understand people's use of ICT.

3.2 Operationalisation of Capabilities Approach to Understand the Equity Implications of eHealth

3.2.1 The Choice Framework

One of the development domains that has attempted to operationalise CA in recent times is technology. The intention of this was to understand the role of technology in achieving a life that people value; i.e. expanding capabilities and achieving functioning that people value (Johnstone, 2007). Coeckelbergh (2011) explains that we often immerse ourselves in understanding how technology has enhanced human life, while operationalising CA. Our focus becomes the relationship between technology

and humans and capabilities. He argues that instead we should focus on people's use of technology and how it has been shaped in terms of capabilities. He presented this as an ethical concern regarding technology enabling people's capability to lead a life they value. This is a highly relevant approach for technology. Often human agency can influence practice. In health we have evidence regarding how people's explanatory model of illness dominates care seeking. Why should it be different in technology? A study of the relationship between ICT and social deprivation conducted in South Africa and China presented the concept of *information literacy skill* as a conversion factor among health workers. It has shown that the absence of information literacy skill can result in a lack of use of computers and health information, due to a restriction of agency freedom (Faith, 2016; Yingqin & Geoff, 2008). Considering the influence of human agency, Kleine presented the Choice Framework (CF) to demonstrate how ICT limits or restricts freedom of choice.

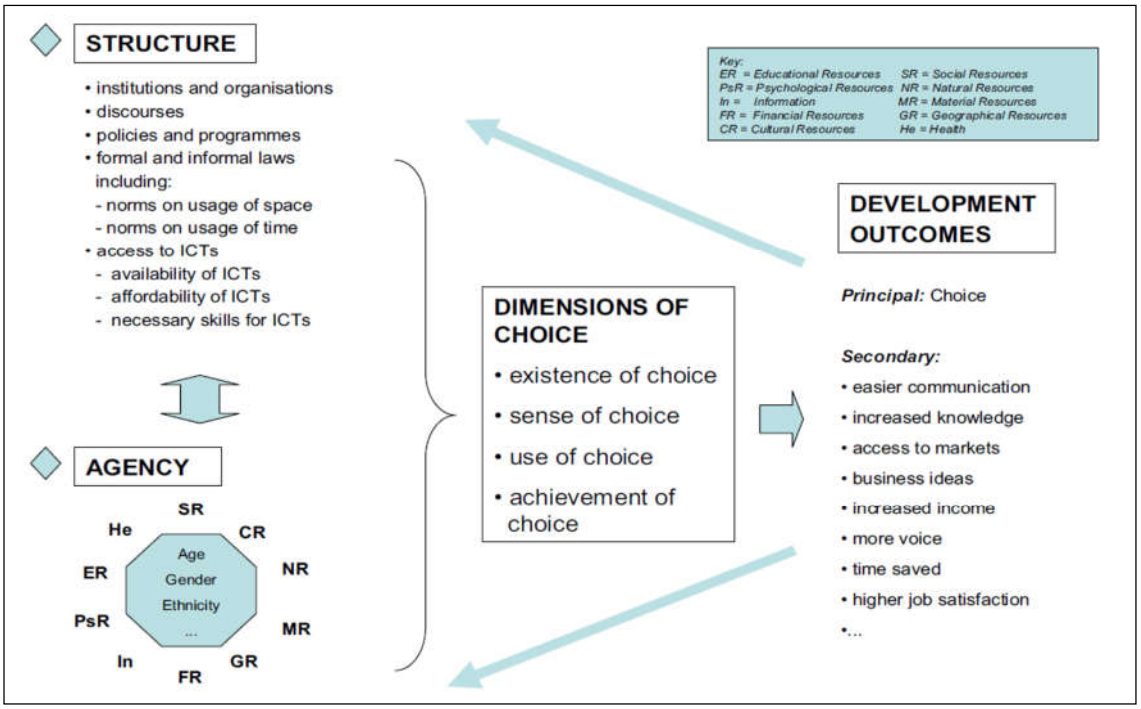


Figure 3.1 Choice Framework (Kleine, 2009)

Inspired by Sen's work, Kleine operationalised the Capability Approach to measure the impact of ICT on human development. Based on an ethnography of Chilean implementation of ICT initiatives, she adopted both Alsop and Heinsohn's work on empowerment and the UK's Department for International Development's (DFID) Sustainable Livelihood Framework (SLF), and through this

developed CF (Figure 3.1). According to the framework, one of the ways to understand the impact of ICT is to explain how technological initiatives can change people's ability to make choices in their lives, for example through easier communication, increased knowledge or access to markets etc. Considering this as the outcome, there are conditions that lead to desired choices called *dimensions of choices.* These include availability of different ways to make choices offered by ICT, people's awareness and use of technological options and acceptability of the results of their use. The framework further describes two capabilities that influence people's dimensions of choice in relation to ICT initiatives; agency and *structure.* Agency-based capability is the amount capital people have, for example in relation to age, gender, ethnicity, material wealth, education, psychological factors, health, social status and geography. Structural capability is the legal and policy environment, norms and customs (formal and informal) that set the stage for ICT initiatives to interact with people (Kleine, 2009; Kleine, 2013, p. 44).

Kleine acknowledges that technology itself can influences people's agency-freedom and thereby may limit its use. This is known as the *determinism continuum* (Kleine, 2013, p. 119; Oosterlaken & van den Hoven, 2012). Having said that, one of the main criticisms of CF is that it assumes that access to ICT creates equality of use, which is contradicted by current evidence on the digital divide (Oosterlaken & van den Hoven, 2012) and by this thesis, too. Evidence suggest that disadvantaged people lack or have less ability to use technology to bring about positive changes to their lives (Faith, 2016; Thomas & Parayil, 2008). Further to this, people's use of technology is closely related and influenced by the oneself and one's surroundings. CF describes these as social and cultural resources. Thus, use of technology can vary between contexts and communities despite availability (Lawson, 2010; Oosterlaken, 2011).

One area which is difficult to explain using CF relates to Bangladesh, where the household ownership of mobile and network is very high and people have accepted tech-based solutions. Yet although eHealth and mHealth initiatives are available, only a few have used this technology for their health needs. And I cannot explain this using CF. As I understand it, CF does not unpack agency-related properties to explain the transformation of people's ability towards their capabilities. This is precisely what Sen has called the conversion factors. I find the interaction among various agency is very important

for the operationalisation of the Capability Approach, especially in terms of understanding the equity implication of eHealth. In the next section, I will discuss the concept of conversion factors in order to operationalise CA, to help in understanding the use of eHealth in contexts like Bangladesh.

3.2.2 Concept of Conversion Factors; Operationalisation of Choice Framework for eHealth

Like CA, CF does not discuss potential unfreedoms that may restrict people's ability to transform their resources into desired capability and/or functioning. This is probably because of the inherent assumption of CF that people perceive ICT to be of good value. And that is perhaps why CF does not discuss the barriers in accessing technology. The concept of conversion factors holds a very important position in understanding the process through which people can convert their agency into capability and functioning. Robeyns (2005, p. 99) suggests that there can be three types of conversion factors:

a. *Personal* (internal to the person) conversion factors includes physical condition, sex, reading skills or the intelligence of an individual. This means if a person has a physical disability or does not know how to ride a bicycle, then a bicycle will be of limited help in enabling the functioning of mobility.
b. *Social* conversion factors are traits of a society in which one lives. These include social norms, policies, unjust or discriminatory practices and hierarchies of a society or power structure regarding gender, caste, class or race.
c. *Environmental* factors come from the physical environment around a person. Often these are geographical characteristics which include climate, physical landmarks like seas or mountains, or pollution etc.

The presence of conversion factors suggests that the resources at an individual's disposal need to go through a process that helps a person to achieve a desired functioning and/or wellbeing. Sen uses capability not to refer exclusively to a person's abilities or other internal powers, but to refer to an opportunity made feasible, and constrained by, both internal (personal) and external (social and

environmental) conversion factors (Crocker, 2008; Nambiar, 2013; Robeyns, 2005). This concept of conversion factor can be a crucial step in operationalisation of CF for my thesis.

Considering the lack of use of eHealth, despite high household ownership of devices in Bangladesh, I think that CF should have an intermediate step between agency and dimensions of choice. This step should show how various agencies are interacting to empower people/users so that we can see the value of using eHealth and use eHealth for the betterment of our health-related wellbeing. This 'way of interaction' can be considered as the conversion factor for people who own technologies to access eHealth and mHealth services. In recent years, the field of eHealth (and mHealth) research has suggested that people need specific skillsets and literacy to be able to use eHealth. This combination of an individual's general and health related knowledge with ways of interacting with information and electronic sources, technological soundness etc. is popularly known as *eHealth literacy*. In the next section, I will discuss the concept of *eHealth Literacy* and its dimensions.

3.2.3 eHealth Literacy: Concepts and Dimensions

Previously I have discussed that the skill and ability to use technology hardware and software can influence its use, commonly known as user-friendliness (van Deursen & van Dijk, 2010; van Deursen et al., 2015). However, eHealth skill requires more than just to be able to press buttons or to navigate a call centre; it requires technological and general health-related skills. Inspired by the concept of health literacy, *eHealth Literacy* describes the skills/capacities required for people to access electronic health information (eHealth). It is the combination of the abilities to read texts, use electronic platforms and use the content to make decisions that makes people to use electronic health information. eHealth literacy has several

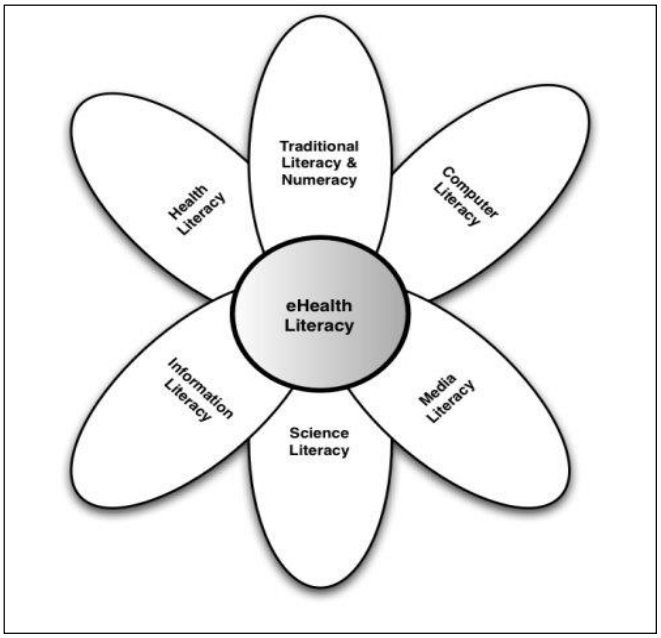


Figure 3.2 eHealth Literacy Lily Model (C. D. Norman & Skinner, 2006)

dimensions, demonstrated by the eHealth Literacy Scale (eHEALS), which can be used to understand and measure the ability of a person or a group to use eHealth (Norman & Skinner, 2006; Stellefson et al., 2011; Werts & Hutton-Rogers, 2013).

The eHEALS was designed based on a model called eHealth literacy or lily model (Figure 3.2). The model consists of six components; traditional, health, information, scientific, media and computer literacies. These six components are broadly grouped as analytical and context specific literacies. The analytical part of the scale refers to the individual's ability to engage with the pool, and their ability to use and share the available information, whatever the reason may be. According to the model, the scale asks three sets of questions regarding: a. an individual's basic language skills such as reading, understanding, speaking and writing texts (traditional literacy), b. their ability to critically think of the content presented in the media, i.e. use of the media-delivered information within their own socio-political environment (media literacy) and c. an individual's ability to organise knowledge, their process of finding information and their ability to share the experience with others (information literacy). The context-specific part of the scale refers to the skills required to access information regarding any specific issue. This includes computer-related skills, scientific skills and knowledge about health to be able to make use of information through eHealth platforms. Computer skill refers to the basic hardware and software skills that helps people to use technology to access information and adopt new technologies. This includes (but is not limited to) powering up and down a device, understanding the techniques of browsing, typing, copying and pasting information, opening email accounts and connecting to the internet or networks etc. Scientific literacy is the familiarity with basic biological concepts and methods, and the ability to understand and/or evaluate scientific facts. Health literacy includes a basic knowledge of the body as needed for making health-related enquiries and understanding advice (functional knowledge), skills to interact with health staffs and institutions (interactive/communicative knowledge) and critical skills (ability to evaluate available health information). A brief description of the six dimensions are given in Box 3.1 (Chan, Matthews, & Kaufman, 2009; Norman, 2011; Norman & Skinner, 2006; Nutbeam, 2009; Stellefson et al., 2011).

Box 3.1: Dimensions of eHealth Literacy

- Traditional literacy and numeracy: this is basic literacy which includes reading text and understanding written passages. Numeracy can be the ability to use/interpret graphs, scales and forms.
- Information literacy: this is the skill to articulate information need, search for it, assess its quality (evaluation) and use it to make a decision and share it with others.
- Media literacy: this is the ability to critically think about audio-visual information; to identify it, assess it, and set it in a social and political context. Or in other words, it is contextualization of information extracted from audio-visual sources.
- Health literacy: this is the ability to engage with the health system. It includes articulating and/or communicating a health problem to a healthcare provider, making decisions, and utilisation of health services etc. In other words, it is the ability to look up, read, understand and act on healthcare information.
- Computer literacy: this is the ability to use computers to solve problems. According to Norman and Skinner (2006), 'computer literacy includes the ability to adapt to new technologies and software and includes both absolute and relative access to eHealth resources'. These skills could include to powering up and down a device to opening a browser, or developing applications depending on the audience.
- Scientific literacy: this refers to making sense of health information based on scientific facts. For example, use of scientific bases to make decisions about managing a health problem. This allows health research findings to be placed in the appropriate context.

There have been a few examples of research around the world that validates eHEALS. It is a set of eight questions, each with a five-point Likert scale response from 'strongly agree' to 'strongly disagree' (Box 3.2) (Norman & Skinner, 2006). The Japan eHEALS test (J-eHEALS) was found to be highly valid and reliable scale. The study stressed the enhancement of people's eHealth literacy for better utilisation of eHealth resources (Mitsutake, Shibata, Ishii, Okazaki, & Oka, 2011). eHEALS was also found to be a useful (valid and reliable) screening tool to document eHealth literacy among older adults in the USA (Chung & Nahm, 2015). A survey of health information-seeking behaviour, related navigational patterns and needs of people with chronic health conditions in Australia. It concluded that web-based information is beneficial for people who have relevant needs. The study used eHEALS to measure self-perceived eHealth literacy (Lee, Hoti, Hughes, & Emmerton, 2015). eHEALS was also used as the core concept of a qualitative study to understand the impact of eHealth and associated skills among young adults regarding their perception of online health information in

Box 3.2: Questions for eHEALS.

- I know how to find helpful health resources on the internet.
- I know how to use the internet to answer my health questions.
- I know what health resources are available on the internet.
- I know where to find helpful health resources on the internet.
- I know how to use the health information I find on the internet to help me.
- I have the skills I need to evaluate the health resources I find on the internet.
- I can tell high quality from low quality health resources on the internet.
- I feel confident in using information from the Internet to make health decisions.

America. The study showed the internet to be an acceptable source of finding and sharing health-related information (Briones, 2015). In 2014, a mixed method study was conducted to understand the usefulness and impact of a web-based dementia portal for informal caregivers and service providers. The study concluded that it is useful and beneficial, as mentioned by the participants. This study also used eHEALS to measure the eHealth literacy of informal caregivers (Schaller et al., 2016). A cross-sectional quantitative assessment of veteran patients' experience of using secure email messaging to communicate with the healthcare providers, found it to be useful. This study also used eHEALS to measure eHealth literacy (Haun, Patel, Lind, & Antinori, 2015). eHEALS was also used to explore the relationship between eHealth literacy and HIV transmission risk behaviours of HIV positive women who were among internet users, visiting social and clinical HIV services in New York. It found that there was a higher association between the eHealth literacy and HIV transmission risk behaviours. Based on this, the study stressed the importance of tailoring the existing eHealth HIV interventions according to people's needs and preferences (Blackstock et al., 2016). Another study of baby boomers in the United States was conducted to understand the influence of socio-demographics, social determinants and device use on eHealth literacy, using eHEALS. According to the study, being younger or more educated was associated with greater eHealth literacy (Tennant et al., 2015). A systematic review of 23 articles on eHealth literacy interventions for older adults reported that three interventions have used eHEALS as the measurement of eHealth literacy while more than half did not use any standardised or validated instrument (Watkins & Xie, 2014).

However, not all have found eHEALS to be very effective. A study of a Dutch population found weak association between eHEALS and internet use and no association between age or education and actual task performance. This study raised a concern about the validity of eHEALS. It included two groups: patients with rheumatic diseases and a group from the general population. The information needs and related behaviour of people with a particular disease is presumably different than the needs and behaviour of the general population. Perhaps the comparison was not a wise way to show the association between eHEALS and internet use (van der Vaart et al., 2011). Besides, this inference regarding the

general population were drawn from a sample of 88, which may have been a reason for an insignificant result in respect to associations for age, education and actual performance (Norman, 2011; Norman & Skinner, 2006). In addition, the changing landscape of internet use, the growing use of mobile internet and social media, may also have influenced the association between eHEALS and internet use (in this case, poor). Considering the growth in internet and social media use, a four-point social component was suggested as an addition to eHEALS; 1. how confidently people are interacting socially over the internet, 2. how confidently people are engaging with professional and non-professional advice, 3. how skilfully people are using mobile devices and 4. the availability of intermediaries for ICT use as relevant and trustworthy sources (Norman, 2011).

Table 3.1 Cognitive process to blend with eHEALS (Chan & Kaufman, 2011)

Cognitive levels	**Tasks**
Level 1: Remembering	Retrieving, recognising, and recalling relevant knowledge
Level 2: Understanding	Constructing meaning from oral, written, and graphic messages through interpreting, classifying, summarising, inferring, comparing, and explaining
Level 3: Applying	Using knowledge to execute a procedure
Level 4: Analysing	Breaking material into constituent parts, and determining how the parts relate to one another and to an overall purpose
Level 5: Evaluating	Making judgments based on criteria and standards
Level 6: Creating	Putting elements together to form a coherent or functional whole in a new pattern or structure

Chan and Kaufman (2011) have further criticised eHEALS from another viewpoint. The basis of their argument is the subjective variation during the use of an electronic means to access health information. This means information-seeking, its processing and responses to it may differ from person to person. Considering the subjective nature of eHEALS, the resultant eHealth literacy can be biased. Being inspired by Bloom's taxonomy of learning behaviour (Krathwohl, 2002), Chan and Kaufman's paper suggested six sequential cognitive steps for each component of eHEALS: remembering, understanding, applying, analysing, evaluating and creating. The steps being sequential, so this implies

that to perform a task, one must go through these steps one after another. A person can understand a concept/task if one can remember it, and they can apply it if they understand it and so on (Chan & Kaufman, 2011; Chan et al., 2009; Krathwohl, 2002). By applying the techniques of cognitive task analysis (CTA), the paper proposed table 3.1 as the steps of cognitive differentiation regarding eHealth literacy among people.

To assess cognitive differences, participants are asked to perform tasks and accordingly cognitive assessment is done. The reasons for CTA to be considered with eHEALS are: a. seeking health information electronically requires the performing of complex tasks using both controlled (conscious, conceptual) and automated (unconscious, procedural or strategic) knowledge (Clark & Estes, 1996; Merriënboer, Clark, & Croock, 2002) and b. eHEALS questions are self-reporting and can be asked in face-to-face interviews or through the Delphi technique, leaving less room for triangulation to validate the responses. Thus, the actual performance of related tasks is not only through demonstration of one's eHealth related skills but it also provides an opportunity for observation and discussion on people's eHealth literacy to a much greater depth (Militello & Hutton, 1998).

Another reason to incorporate techniques of CTA with eHEALS is that eHealth helps people with a wide range of health-related activities. These include self-management of illnesses, engaging with healthcare providers and/or peers, preparing and following a healthy lifestyle, and accessing information regarding healthcare etc. To do that various applications (apps), portals and services are available. But to use these sources, one needs to have a specific set of skills depending on the type of platform in use, which can be challenging for many (Ahmed et al., 2014b; Chan & Kaufman, 2011). Table 3.2 shows some of these skills and related challenges. Observation and making notes of these challenges can be a way to explain one's level of eHealth literacy. Therefore, the advantage of integrating CTA with eHEALS provides us the opportunity to triangulate participants' responses more objectively. However, in the context of Bangladesh there can be a few constraints to applying techniques of CTA with eHEALS: a. not all forms of eHealth services and portals may be available in Bangladesh, b. the question of which device should be used for performing the tasks, i.e. computer, mobile or both and c. among the available

eHealth options, SMS and call centre-based initiatives are the most popular. Therefore, the tasks should include SMS and voice calling as well. In the method section this has been discussed in more detail.

Table 3.2 Documented skill-related challenges to the use of common eHealth tools (Chan & Kaufman, 2011)

eHealth tool	**Example of tasks**	**Examples of skill-related challenges in completing eHealth tasks**
Health information portals	Looking up information about treatment options for a health condition	• Identifying appropriate and reliable sources; assessing quality of information • Using effective information retrieval strategies • Understanding complex technical language • Comprehending materials written above recommended reading levels
Personal health records	Entering personal information into medical record	• Having computer skills to effectively use all the different features and tools • Being familiar with health concepts to enter and extract appropriate information in record
Telemedicine or teleconsultation applications	Communicating with health care providers	• Effectively using communication tools • Interpreting and using health information appropriately for self-care activities
Decision-support tools	Evaluating and weighing evidence to inform a decision	• Understanding risk and uncertainty • Obtaining and evaluating evidence-based information
Online support or chat groups	Participating in discussion forum	• Communicating ideas clearly; adhering to online social etiquette and group norms • Effectively sharing information without compromising one's privacy

However, applying CTA to its fullest to capture individual cognitive differences with respect to eHealth literacy is certainly not easy. First of all, these cognitive steps involve the whole continuum of information seeking; from seeking to decision-making. In real life we do not always seek information to make decisions. Also, the given scenario for task performance may be completely new to the participants. Therefore, the exercise may vary widely due to subjective experience and perspective. Secondly, applying CTA requires special sets of skills regarding cognitive learning which is beyond my ability. It would have been ideal to use CTA techniques, but these can be modified by asking participants to perform tasks related to accessing health information electronically. This can certainly provide an opportunity to

objectively verify one's level of eHealth literacy with additional observational notes. From the quantitative viewpoint, eHEALS can score people's eHealth literacy between eight to 40. As already mentioned, eHEALS is a set of eight questions (Box 3.1) and the response to each is a five-point Likert scale, 'strongly agree' being five to 'strongly disagree' being one. For an in-depth understanding of eHealth literacy, the Lily model of eHealth literacy was recently revisited by a group of computer scientists, academics, health professionals, and patients recruited from patient organisations and primary care to give a more field-oriented, enquiry-driven framework. After rigorous consultation meetings, surveys and discussions, seven domains were identified, grouped into three categories (Table 3.3). Thus, the six dimensions of the Lily model of eHealth literacy was operationalised to give an in-depth understanding of eHealth literacy in a population.

Table 3.3: Extended dimensions of eHEALS (Kayser, Kushniruk, Osborne, Norgaard & Turner, 2015)

Capabilities
Knowledge about one's own health (Domain 1) Know about the body's basic functions and structure and own current health status. Aware of risk factors and how to avoid them or reduce their influence on own health. *Ability to interact with information (Domain 2)* Able to read, write and remember, apply basic numerical concepts, and understand context-specific language (e.g., health, IT or the user's native language, as well as critically appraise information. Know when, how and what information to use. *Ability to engage with technology (Domain 3)* Being comfortable using computers and other digital media for handling information.
Access to technologies
Access to technologies that work (Domain 4) Have access to technologies (e.g. computers and other digital media) that the users trust to be working *when* they need it and *as* they expect it to work. *Access to technologies that suit individual needs (Domain 5)* Have access to technologies that are adaptable to the specific needs and preferences of the users. This includes responsive features of both technologies and the healthcare system (including carers) as well as adaptation of devices and interfaces to be used by people with physical and mental disabilities.
Experience using technologies
Feel that using technologies is beneficial (Domain 6) Feel that engaging in the use of technologies will help them to manage their health more effectively than by other means. *Feel in control and secure when using technologies (Domain 7)* Feel that you have the ownership of personal data stored in the systems and that the data are safe and can be accessed only by people to whom they are relevant (own doctor, own nurse etc.)

These extended dimensions of eHEALS lack the social media dimensions that were explained before. Considering that it is also part of eHEALS, eHealth literacy is surely related to human agency and

has the potential to explain how people can use eHealth to access healthcare. Therefore, the eHealth literacy concept can be a crucial part of operationalising CA to explore the equity dimensions of eHealth as conversion factors. In the next section, I will discuss a potential conceptual framework for understanding the use of eHealth to access healthcare in Bangladesh. To do that, I will show eHealth literacy as a conversion factor and explain the related agency, structural factors, capability pathway and functionings.

3.3 Conceptual Framework Explaining How eHealth Can Be Used to Access Healthcare and Related Research Questions

3.3.1 eHealth Literacy as a Conversion Factor: Critical Reflection

In a simple way, eHealth literacy suggests the ability to be able to access healthcare through electronic platforms. At this point, I persuaded by the concept of eHealth Literacy to assume that in the case of a population having technology at their disposal (ownership), specific literacy can facilitate the use of technology for a purpose; in this case, eHealth. It shows a pathway of interaction where personal resources are directed towards the use of technology. It is a practical approach to explain how a group of people with access to technology can make use of it to best meet their needs. Thus, it is an intermediate step that connects personal agency with the dimensions of choices in Kleine's CF, operationalised for access to healthcare through eHealth. And thereby the dimensions of eHealth literacy can be considered as conversion factors altogether for a population with access to technology.

It is also important to note that traits of personal agency can vary among individuals and groups, and so too does their ability to convert resources into capabilities and functionings. This means that based on the evidence of the digital divide, individuals or groups can have varied levels of eHealth literacy which can result into unequal access to eHealth. Therefore, studying eHealth literacy among people can help in understanding and explaining subjective variation in access to eHealth. There is another aspect of eHealth literacy that is not directly related to people but can influence their eHealth literacy. This relates

to the ICT landscape, norms and provisions of a country. Therefore, understanding personal agency and structural factors related to eHealth literacy can help to explain the conditions necessary for people to be able to access eHealth using their access to technology; conversion factors.

3.3.2 Conceptual Framework for eHealth and Related Research Questions

The aim of my thesis is to understand why the people in Bangladesh who have mobile phones do not use eHealth and mHealth services to seek health services and/or information and thereby improve health equity. Based on the literature and context of Bangladesh, the premises of my thesis are:

- In the context of rapidly spreading technology, innovations are usually adopted by people in steps by group (theory of DOI). This essentially means that some groups have certain characteristics that makes them early adopters and others gradually acquire similar characteristics over time and become users.
- People have various potential capabilities to attain certain functionings which they value or have reasons to value. In case of ICT, personal agency and structural factors determine a person's freedom to choose ICT solutions in order to bring about changes in their lives (Choice Framework).
- It is important to consider certain factors (Conversion Factors) that help a person or group to transform personal/group resources into functionings. These are often understood as individual (biological), societal and environmental factors.
- eHealth literacy is a freedom (capability) that can help people to use technology to seek healthcare electronically. Therefore, dimensions of eHealth literacy can be considered as the conversion factors for people to be able to use their access to technology for seeking health services and/or information.
- Interactions between personal agency and the dimensions of eHealth literacy (conversion factors) can help us to understand subjective variations in access to eHealth and thereby in access to

healthcare through electronic platforms. Therefore, these factors and interactions can be used to understand the equity implications of eHealth.

Figure 3.3 shows the conceptual framework for my thesis. In the framework, achieving or being in good health are considered as the functionings that people want to achieve in the context of health disparity. To achieve that, access to good healthcare is a precondition. Access to healthcare in this regard can be the use of health services or information or both. This can involve a wide range of activities, such as easier communication between community and healthcare providers, less expensive and less time consuming care seeking compared to conventional, better knowledge of health and illness, navigating the health system (i.e. location of the provider, cost of care etc.), better management of illnesses, availability of care even in odd times etc. The rest of the framework explains how eHealth can help people to access healthcare.

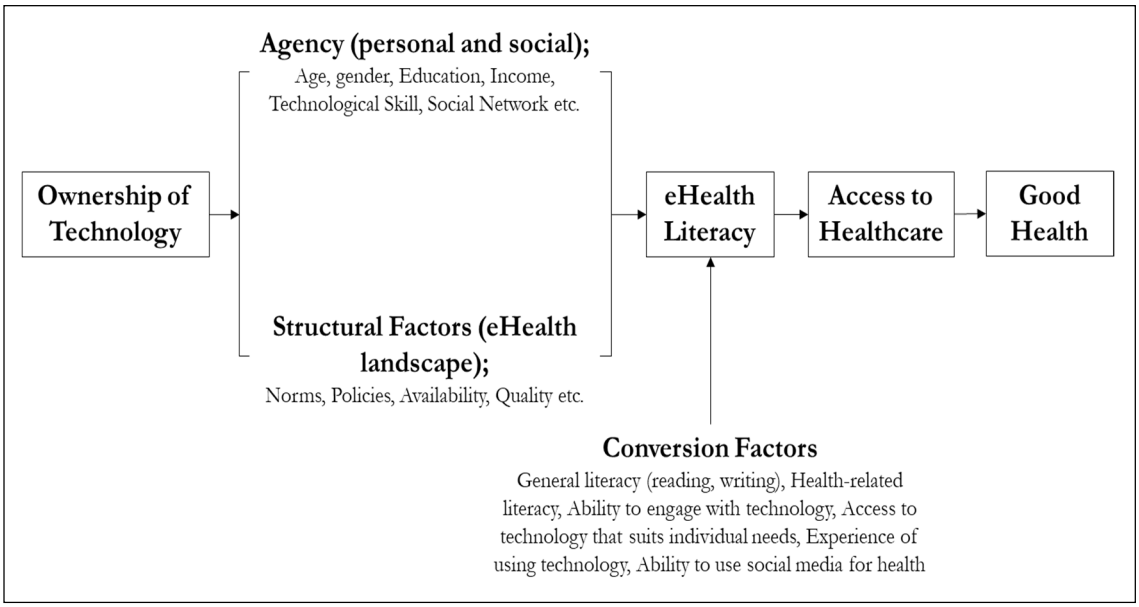


Figure 3.3 Conceptual framework for understanding the equity implication of eHealth in accessing healthcare

eHealth Literacy represents the collection of conversion factors that helps the owners to use their phones or laptops (or both) for seeking eHealth, together with structural factors and agency. Structural factors are the context factors which include the current legal and political context favouring the growth of eHealth in Bangladesh, eHealth actors and initiatives in the country, norms and customs related to the implementation of these initiatives (both formal and informal) etc. In other words, it is the eHealth

landscape of Bangladesh, that has been covered in the literature review chapter. Agency is a person's ability to act in the world (for Sen, to act in pursuance of the life that they have reason to value). It exists in the context of structure; where structure is the 'landscape' of rules, institutions, power relationships, social norms and values that constrain and make possible our freedom of action. The interplay between agency and structure, the extent to which we are free to change society, is central to the social sciences. In the Choice Framework diagram (see Figure 3.1) Kleine illustrates technology access as constrained/enabled by structure. I interpret to mean for example that it determines that some privileged people have mobile phones and skills whilst other relatively disadvantaged people do not. Thus, agency is made up of the personal, socio-demographic and economic characteristics that primarily constitute the conditions for eHealth literacy and thereby for accessing eHealth. These include age, gender, education and income. Perceptions of using eHealth to access healthcare is also considered as an agency, as it influences people in making choices. In the CF, Kleine has referred to this as psychological resource. Understanding social networks and technical skill as agency is also an adoption of Kleine's CF, and these are important resources that enable people to perceive technological platforms and solutions as a mean to achieve wellbeing.

Ownership of technology refers to owning any device, i.e. computer, mobile phone or both, and subscription to a mobile and cellular network. The assumption in the conceptual framework, is that given the right interplay between agency and structural factors, the owners will be able to achieve appropriate eHealth literacy (conversion factors) to use eHealth to access healthcare. Considering this conceptual framework, I will demonstrate the equity implications of eHealth in accessing health in Bangladesh. And to do that, I will explore the following research questions:

General Research Question:

To what extent are electronic platforms and access to mobile phones and the internet affecting (reducing or increasing) disparity in access to healthcare for the people of Bangladesh? I have broken down this general question into following sub-questions:

Sub-questions:

1. How is access to (use and awareness of) healthcare through electronic means affected by socio-demographic factors such as age, gender, education, SES, and personal and household ownership of mobile phones in a semi-urban community in Bangladesh? The main objective of this question is to understand who has access to eHealth and mHealth by applying a socio-demographic lens (e.g. age, gender, education, socioeconomic status) to the ownership of electronic devices. I expect to identify groups or a group with higher access and weigh the findings with the existing literature regarding the digital divide.
2. What determines the use of eHealth to access healthcare and related information by young and educated adults in a semi-urban community in Bangladesh (who own electronic devices and have been reported to be the population group most enthusiastic about technology)? I expect that for question 1, I will find that young and educated adults are most likely to use eHealth to access healthcare. The reasons for this assumption are the theory of DOI and the evidence of a digital divide in eHealth and mHealth in Bangladesh. The objective of question two is to understand what determines access to healthcare through electronic means for the owners of devices. To explore that, I will consider socio-demographic characteristics and skill to see how agency is related to access. For this, I will address the following questions:
    a. Do young and educated adults of *Mirzapur* have access to electronic platforms in terms of personal or household ownership of devices (i.e. mobile phones and/or laptop/computer)?
    b. How able are young and educated adults of Mirzapur to use electronic devices and platforms?
    c. Do young and educated adults of *Mirzapur* with access to electronic platforms uses their devices to seek health information and/or services?
    d. How do gender and SES relate to the access to and use of electronic platforms for seek health information and/or services, for young and educated adults of *Mirzapur*?

3. What constitutes skill in using technological means to access healthcare and information, and how does it differ by individual perception and actual skill level? This explores individual and/or group agency where it influences access to healthcare through technology. It takes a deeper look at individuals' capacity to use eHealth services, with eHealth literacy as the conversion factor (Figure 3.3). This means, rather than considering capacity/skill as a mere combination of technical and interpretive ability, an individual's ability is understood as 'literacy.' And thereby it also examines the potential of alternate means to study the 'skills' that determine use of digital health services or information. This will be explored by using the following set of questions:
    a. What are the perceived and observed skill levels (eHealth literacy) of college students in Mirzapur in terms of accessing health information and services electronically?
    b. Are there any differences between the perceived and observed skills (eHealth literacy) of the college students of Mirzapur to access health information and services electronically, and if so, why?
    c. What are the scopes and challenges regarding skills for accessing health information and services electronically (eHealth literacy) for the college students of Mirzapur?

In the next chapter I will describe the methods and materials used to explore these research questions.

Chapter 4 | Equity Implications of eHealth in Bangladesh: Methods and Materials

In this chapter, I describe the methodological approach of my thesis. Based on the research questions, I have explored the use of eHealth to access healthcare and related equity dimensions using a logical flow; one leading to the next one. Before discussing the methods and materials of my thesis, perhaps it is better to start with operationalising eHealth. The World Health Organisation (WHO) explains eHealth as the spectrum of technologies including computers, telephony and wireless communications providing access to healthcare and mHealth is a subset of eHealth referring to the same via mobile phones only (Ahmed et al., 2014a.). In this thesis, I have used eHealth to mean use of technology to access the internet, SMS- or app-based healthcare or voice-based consultations (telemedicine) and it can be via a computer or mobile phone. Thus, wherever I refer to 'access to eHealth' or access to health through electronic/digital means/platforms, I am referring to seeking health services (i.e. consultation) and/or health information.

The first step was to understand who uses electronic devices for eHealth services to seek healthcare. This was analysed to narrow down to identify socio-demographic group(s) who accessed eHealth. In the second step, I explored their skills to find out how far technological competence determined use. And as a third step, I have explored eHealth literacy to explain the underlying causes for using devices to access eHealth services. eHealth services were operationalised both as health services and as information. This has broadened the scope of the research to include health-related queries and knowledge as well as medical services such as telemedicine, both of which are part of care-seeking behaviour. Finally, I went back to my conceptual framework in light of the findings to come up with a framework specific to the equity implications of eHealth in regard to accessing healthcare. In the subsequent sections, I will describe my method and tools by research questions.

It is also important to remember that throughout this thesis, access to/use of eHealth does not refer to any group or specific health and technology intervention(s). Although in the literature review, I

have mentioned about 42 ongoing and past eHealth initiatives, considering the low use, we considered very basic uses of technology, ranging from using mobile phones and computers to browse internet for health information, calling health call centre and calling friends and families to seek health-related help. Otherwise stratification by any of the initiatives mentioned might have resulted into too small a frequency, preventing further analysis.

4.1 Research Design

Based on the complex nature of my inquiry, I have used both quantitative and qualitative techniques. The reasons for choosing both were: a. I needed quantitative information to be able identify patterns of use of eHealth by different socio-demographic groups and b. I needed to explore subjective and group-specific explanations regarding the use of eHealth. Thus, the design of my thesis was mixed method with the flexibility to be able to blend quantitative and qualitative tools. This also gave me the opportunity to apply role playing techniques and task performance by the participants and its observation to add scientific rigour (triangulation) as well as to ensure authenticity. And all these methods are applied, either singly or in combination, in a step-by-step manner.

4.2 Research Site

The research was conducted in a sub-district of Bangladesh called Mirzapur. It is a typical semi-urban sub-district under Tangail district, having an area of 374 km2 (see Annexure 5 for map). It is approximately 60 km north of Dhaka (the capital) and takes two hours by car or bus. It has a health and demographic surveillance system (HDSS) of ~240,000 individuals living in 58,300 households, run by International Centre for Diarrhoeal Disease Research, Bangladesh (icddr,b). The HDSS updates statistics like births, deaths and migrations in every four months. In Mirzapur, approximately three-fifth of the households have electricity. Men are mostly employed either in agricultural farming, as daily wage

labourers or as international migrant labourers and women are mostly housewives. The main forms of transportation are bus, and motorised and cycle rickshaws (Das et al., 2013).

4.3 Sampling, Research Tools and Analysis

4.3.1 Who uses eHealth to Access Healthcare in Mirzapur and Why?

This was the first research question of my thesis. The question was further elaborated as: *how is access to (use and awareness of) healthcare through electronic means affected by socio-demographic factors such as age, gender, education, SES, and by personal and household ownership of mobile phones in a semi-urban community in Bangladesh?* I wanted to know the pattern of use of eHealth to access healthcare by various socio-demographic groups and the underlying reasons with explanations for the use. Therefore, I used mixed-method techniques (both quantitative and qualitative data). The quantitative component of the study comes from a household survey conducted during October 2013 and February 2014 at three locations in Bangladesh: *Chakaria* (a rural sub-district), *Mirzapur* (a semi-urban sub-district) and *Dhaka* (the five largest slums of the capital city). It was conducted jointly by the Institute of Development Studies (IDS), UK (http://www.ids.ac.uk/) and the International Center for Diarrhoeal Disease Research, Bangladesh (http://www.icddrb.org/) to explore the role of ICTs in health information seeking. For this study, a semi-urban location (Mirzapur) was chosen because; a. it has both rural and urban areas and b. it has the characteristics of a typical semi-urban sub-district of Bangladesh and is fairly close to Dhaka (60 km north of Dhaka and two hours' car drive away). After the quantitative analysis, the findings were further followed up using qualitative techniques during February to March 2017 as part of my PhD fieldwork. This helped in understanding the implicit explanations of the pattern; mostly the WHY part of the inquiry. I also contributed substantially to the design and implementation of the survey.

The sampling frame of the survey was general population of Mirzapur. In the absence of prior variance estimates of the outcome variables, a value of 0.5 (the maximum for dichotomous variables) was used to calculate the required sample size to obtain 95% confidence limits with a precision of ±10%,

assuming a design effect of 2. This suggested a sample size of 2520 households (for all three location) with 5% buffer for the probable non-response rate. Thus 840 households were selected, using systematic cluster sampling from a Health and Demographic Surveillance in Mirzapur, from 28 villages (30 households per village). In most cases (over 81%), information was gathered from the head of the household or the spouse of the head. Where this person was not present or was unwilling to respond, the respondent was usually an adult child of the head, or the spouse of a child. The survey questionnaire was devised on a browser-based platform, which ran on both Windows and Android OS. It had two components: front-end (or user interface), and back-end (or administration database). The front-end was used both for data collection and management while the backend was used for data management and extraction. The questionnaire was developed both in Bangla and English and was pre-tested before implementing in the field, to understand the overall quality of the questionnaire and the effectiveness of the electronic version on android-based seven-inch tablets.

A team of 14 trained researchers: one supervisor, ten enumerators, a quality controller, a data manager and a technical support officer conducted the survey using 11 seven-inch tablets. Data was uploaded to a central server at the end of each day and the synchronisation process automatically deleted the data from local storage (Tab). After uploading, the data management team which was based in Dhaka, randomly selected five to 10 questionnaires and emailed identifiers to the supervisor and the quality controller for recheck (Day 2). By the end of Day 3, the supervisor uploaded the rechecked data into the server and on Day 4 the data management team updated the data to the main database. The data management team used a dedicated Wi-Fi based internet connection and the field team used a mobile phone network if Wi-Fi was not available. The interviews were conducted after obtaining proper written consent (thumb print for those who could not sign).

Considering there was not enough information in the survey to indicate the reasons for not using electronic platforms to seek health information and/or care, follow-up focus group discussions (FGDs) were held with prefixed socio-demographic groups. The survey was conducted in 2014 and the FGDs were conducted in 2017. Due to the gap, it was difficult to track all participants as many were unavailable,

mainly due to out-migration. Therefore, groups were created using HDSS data for Mirzapur and the snowball technique. Factors considered to form the groups were SES (rich/poor), gender (male/female), age (young and adults, middle aged and elderly) and education (student and general population). Altogether, 20 FGDs representing six groups were conducted. Other than the demographic characteristics, the only inclusion criteria used was: 'have never used electronic devices to seek health services and/or information' (in case of respondents outside the survey sample frame). However, for the middle-aged group, a few chosen participants were younger than middle age. Considering their non-student status and their involvement in activities like earning a living and/or household work, they were deemed to have similar worldviews to the middle-age group. Because of their younger age, group cohesion was carefully observed during the discussion. I was ready to terminate the discussion and move to the next group in the event of any undue tension (i.e. suppression of opinion) due to the age mismatch but the discussion went well and smoothly.

All FGDs were conducted in places preferred by the participants. This was often the household in the case of female participants, and around any local gathering place in case of male participants. Discussion was facilitated by me as the PhD student. As facilitator, my main objective was to retain the focus of the group on the discussion and look for agreement among the participants as much as possible. However, disagreements were also noted, in addition to participants' body language. Each FGD lasted for about 25 to 30 minutes. All discussion was documented with observation notes which were as detailed as possible and the discussions were also audio recorded (with permission from the participants). The FGD sessions were given unique IDs and were transcribed first into Bangla, and then an English summary of each was prepared, both by me. Before beginning the FGD, all the participants were asked to provide written consent after the ethical aspect(s) of participation were explained to them. Each FGD was conducted following open-ended and flexible guidelines, which were developed on mainly two themes: a. Why did they not use electronic devices for seeking health care and b. People's expectations of eHealth as a means to seek healthcare. For research question 1, I have presented the findings from the first theme of the FGD.

The distribution of the quantitative data is presented through simple univariate analyses which included measures of central tendency. This also showed the differences (both in numbers and proportions) between the users of eHealth to seek healthcare and the non-users regarding age, gender, education, income and ownership of electronic devices. To understand the statistical significance, a *chi square* test was done between the groups; categorical variable. Household and personal ownership of devices (mobile phone, laptop or both) was considered as a proxy for access to eHealth. Using of electronic devices to seek eHealth was operationalised as seeking health services and/or information and/or both. Categories considered for this were: using a phone to call a health call centre and discuss illness (for treatment or advice regarding a disease, asking about healthcare costs or a possible doctor etc.), using the internet to look for health information from any formal and/or informal group (patient group, health portal etc.), using any internet-based and/or call centre-based consultation/counselling services, using text messages to make an enquiry about a specific health-related issue (i.e. to convey health status, receive advice, make complaints etc.).

The qualitative analysis followed up on the distribution showed by the quantitative analysis. Patterns were identified to describe the reasons for not using mobile phones and/or PC/laptops considering the context. To that end, a popular qualitative technique known as *content analysis* was used (Krippendorff, 2004; Mayring, 2000). Focus group discussions were conducted mainly to understand the reasons for not using electronic devices for seeking health services and/or information. The findings were grouped as three broad themes; a. reasons for not using (my intention was to make list of reason), b. awareness (to understand if the participants were aware of such electronic sources) and c. the role of intermediaries (asking anyone in the family or peer network to look for health information using electronic devices). To align and arrange the information, iterative analysis was done. This means, audio-recorded interviews were listened to and transcribed regularly. In addition, a field diary was maintained to record the day-to-day details of the fieldwork, i.e. field experiences, personal feelings, body language of the informants and any remarkable incidents. This helped to identify new/emerging issues, the strengths and weaknesses of interview techniques and any missed opportunities for further exploration.

The findings were first arranged by typicality. This means if there was consensus within the group(s), it was considered a pattern. For those with disagreements, these were recorded as atypical/deviant findings and were carefully noted to interpret variations across the context. This is also called the inductive method of analysis using a thematic approach. Finally, both qualitative and quantitative findings were put together to see how they complemented each other and presented accordingly.

4.3.2 What Determines the Use of eHealth to Access Healthcare by the Young Educated Adults of Mirzapur?

The second question of my thesis is: *what determines the use of eHealth to access healthcare and related information by young and educated adults in a semi-urban community in Bangladesh (who own electronic devices and have been reported to be the population group most enthusiastic about technology)?* Based on the evidence and also the theory of DOI, it was expected that young and educated adults will be more into using eHealth to access healthcare. This expectation was correct. For easy exploration and analysis, the determinants of this group's use of eHealth were broken down to four steps: ownership of devices, whether the owners use their devices to access eHealth, whether their use of devices to access eHealth is influenced by their technological ability/skill and how socio-demographic factors influences technological ability/skill and use. To understand these determinants, I have used another quantitative survey that I was an active part of. It was a survey of young educated adults (college students), jointly led by the Institute of Development Studies (IDS), UK (http://www.ids.ac.uk/) and the International Center for Diarrhoeal Disease Research, Bangladesh (http://www.icddrb.org/) during August to October 2015. It was conducted in two locations in Bangladesh, Chakaria (a rural sub-district) and Mirzapur (a semi-urban sub-district). For this research question, Mirzapur was chosen and data was collected form Mirzapur Degree College and Government Saadat Colleges. The target sample set for each college was 220 (with an extra 10 for keeping non-responses at a minimum).

Analysis of this part is limited to univariate techniques and measures of central tendencies. Only for nominal variables like age, mean, median and range was performed to understand the distribution. For the rest, variables were presented with actual numbers and proportion (%) and differences between

groups were examined using non-parametric test *(chi-square)*. Any difference that had a p-value of <0.5 was considered a significant difference in distribution. To do this, both STATA (version 14) and Microsoft Excel 2017 (Office 365) were used. At first participants were described using general socio-demographic characteristics. Then variables were created and looked-for distribution, sequentially. Since all respondents belonged to the young and educated adult group, education and age were not considered for stratification of the distribution. Thus, only gender and SES were used. For SES stratification, five groups were considered: quintiles from bottom to top being poorest, poor, middle, rich and richest. Access to electronic platforms was considered as well as ownership of devices and skill/capacities to use those devices. The data was presented as ownership of devices (mobile phone and/or laptop/PC) at personal and household level. Then those who had any ownership (personal and/or household) were grouped based on their technical skill (ability to navigate the device, change ringtones, wallpapers, music etc.; ability to send and receive SMS; ability to use any mobile-based service e.g. sending and/or receiving money, ability to do social networking (Facebook, WhatsApp, Tango, Viber, WeChat etc.) and ability to do video conversation (Skype)). From navigation to video, these skills were then given serial numbers from 1 to 5 based on the complexity of the use. Anyone who had all 5 or 4 or above were categorised as having high skill. Respondents withe skills at 2 or 3 were categorised as medium skill and those with skill only up to 1 were grouped low in skill. The rest were considered as group with no skill. Then another variable was created for both personal and owners of owners of electronic devices: interpretive skill. Ability to read SMS alone or only with someone's help was considered as high and low interpretive skill respectively. Use of electronic platforms was considered as well as using voice calling and/or SMS to consult with a call centre or a doctor and/or browse the internet for health information and/or services. Using the technical and interpretive skill groups, 12 possible combinations were constructed as individual groups to see whether they had used or were aware of seeking health information and/or services electronically (Table 4.1). Finally, in each step, gender and SES stratifications were done and significance was analysed through *chi-square* test. Tables presented in Chapter Six demonstrate the actual numbers and related proportions in parenthesis and at the p-value for *chi-square*.

Table 4.1 Skill groups of college students who owned personal and household mobile phones and/or laptop/PC.

Technical Skill	Interpretive Skill	Name of the Group
High	High	HH
High	Low	HL
High	No Skill	HN
Medium	High	MH
Medium	Low	ML
Medium	No Skill	MN
Low	High	LH
Low	Low	LL
Low	No Skill	LN
No Skill	High	NH
No Skill	Low	NL
No Skill	No skill	NN

4.3.3 eHealth Literacy of the Young and Educated Adults of Mirzapur; How It Influences the Use of eHealth To Access Healthcare?

In the previous chapter we have discussed eHealth literacy and how it can be operationalised as eHEALS to understand the concept of conversion factors. This research question was designed to explore – what constitutes skill that enables the use of technology to access healthcare and information and how does it differ by individuals' perceptions and actual level? To understand the eHealth literacy of young, educated adults, I used eHEALS in three steps: a. I addressed eHEALS questions to the participants and used the responses for eHealth literacy as 'claimed'; b. I asked the participants to perform tasks based on the eHEALS questions and I observed their performance to see their eHealth literacy in real life ('observed') and c. I used the dimensions of eHEALS as the interview guideline and explored participants' perception of eHealth literacy to understand who has access to healthcare through electronic means and who do not. Altogether, 70 college students (35 male and 25 female) from Mirzapur Degree College (MDC) were chosen through the snowball technique (Patton, 2001).

Data analysis of eHealth literacy was also done in three steps: calculating the eHEALS score, verification of the eHEALS score and understanding the scopes and challenges associated with the eHEALS score. Details of the analysis are given below:

a. *Calculating eHEALS score (claimed).* All the participants were asked eight questions (Box 3.2) and the participants were asked to what degree they agreed or disagreed. Their responses were scored

between one and five, one being 'strongly disagree' and five being 'strongly agree'. After answering all eight questions, the scores for each question were summed up to get the total eHEALS score for each participant. After that, for the purpose of description, univariate analysis (measures of central tendency) of the total score and question by question was performed and presented. The calculation was done using Microsoft Excel 2016 edition. Table 4.2 shows the matrix used to calculate eHEALS score.

Table 4.2: Matrix used to calculate eHealth literacy score of the participants (eHEALS)

Response / **Questions**	**Strongly Disagree** 1	**Disagree** 2	**Neither agree nor disagree** 3	**Agree** 4	**Strongly agree** 5
I know how to find helpful health resources on the internet.					
I know how to use the internet to answer my health questions.					
I know what health resources are available on the internet.					
I know where to find helpful health resources on the internet.					
I know how to use the health information I find on the internet to help me.					
I have the skills I need to evaluate the health resources I find on the internet.					
I can tell high quality from low quality health resources on the internet.					
I feel confident in using information from the internet to make health decisions.					

b. *Verification of the eHEALS score.* this involved observation of participants performing tasks based on the statements in eHEALS. Each task was divided into anticipated steps which acted as the observation checklist. As tasks were being performed, with this checklist, I concluded whether the participants could perform the task easily, could perform the task with difficulty or could not perform the task (half done or not at all). Later I used this observation for triangulation with the eHEALS score (claimed) and formed a conclusion regarding the participants' eHealth literacy. Analysis was done manually but the data was recorded on Microsoft Excel 2016 edition.

Altogether, four tasks were prepared on both mobile and laptops. The tasks were designed to test participants' skills regarding SMS, internet browsing, social media and voice calling. The following list shows the tasks and corresponding checklist for observations:

Task 1: Participants were given a laptop and a mobile phone to look up information about treatment options for sexual and reproductive health issues and/or related decision-making while I observed the following: 1. booting up the device, 2. opening an internet browser, 3. navigating to any search engine, 4. entering search words, 5. choosing appropriate websites, 6. using effective information retrieval strategies, 7. understanding complex technical language, 8. comprehending materials written above recommended reading levels, 9. understanding risk and uncertainty (clicking unwanted sites and pop ups, reasons for not doing etc.), 10. obtaining and evaluating evidence-based information and 11. making decisions.

Task 2: Participating in a social media discussion forum: participants were asked to interact over a known Facebook page for the purpose of this research and asked to be a member of that page (if not already). After that they were asked to participate in the ongoing discussion or initiate a new thread while I observed for: 1) how confidently participants were interacting socially over the internet, 2) engaging with professional and non-professional advice, 3) skill in using mobile devices for social media, 4) availability of apomediaries (intermediaries of ICT use) for relevant and trustworthy sources, and 5) effectively sharing information without compromising one's privacy.

Task 3: Participants were sent a sample SMS containing health information and asked to read and explain the content and if possible share/forward/reply while I observed the following to understand their use of SMS to make health related communication: 1. familiarity with SMS, 2. understanding the reason for SMS communication and 3. sending SMS.

Task 4: Participants were asked to make a call to any available health line (I used an available network provider-operated health call centres - in most cases it was 789, operated by GrameenPhone) and asked to make a general enquiry based on a given scenario. And I observed

this teleconsultation to understand 1. effective use of communication tools, 2. appropriate and interpretation and use of health information for self-care activities etc.

As a preparation for the tasks, I adopted a few steps appropriate for the Bangladeshi context.

a. Sexual and reproductive health was chosen as a scenario for these tasks. For example, participants were asked to find the Bangladesh government's Facebook page for HIV and AIDS. When they made a call to the call centre, participants were asked to talk about someone can avoid contracting HIV while donating blood, etc. The reason for choosing sexual and reproductive health was because it is a very popular programme in Bangladesh, aimed at adolescents and young males and females.
b. The objective of these tasks was to explore the challenges in the context of Bangladesh in terms of seeking healthcare through eHealth. And there are many forms of eHealth for health information. During this data collection, there were no decision support tools, or online support or chat groups available in Bangladesh (Ahmed et al., 2014b; BKMI, 2014). For the evaluation of task performance, participants' ability to search for health information using the available health portals was considered. Considering the context of Bangladesh, Google and Facebook were chosen for this.
c. Table 3.2 mentioned that eHealth tools are chiefly based on the internet except telemedicine. In Bangladesh and many other similar contexts, both computers and mobile phones are the means to gain access to the internet. Hence the tasks used both computers and mobile phones.
d. SMS-based services are probably the most popular form of eHealth services in Bangladesh, especially in the case of awareness raising (Ahmed et al., 2014a; BKMI, 2014). Table 3.2 does not include challenges of SMS based tools. However, it is essential that skills to access health information through SMS need to be explored given its widespread coverage (MAMA, 2015; Rajan et al., 2013). SMS-based services are primarily of two forms: a) awareness building, and b) governance related; i.e. to make complaints or to communicate with any healthcare

provider. As a task, it was not feasible to understand people's behaviour after receiving a SMS message, as it can be biased due to the interview setting and my presence as the interviewer. But a task involving sending a SMS message for a hypothetical scenario was deemed feasible. The detail of skills related to SMS-based awareness were explored through interviews.

Understanding the scopes and challenges associated with the eHEALS score: the dimensions of eHEALS were then used to create in-depth interview (IDI) guidelines based on five themes, each with sub-themes (Annexure 6). These themes were related to general experience of the participants regarding performance of the tasks, individual knowledge and understanding of health (in this case sexual and reproductive health), ability to interact with information, access to technology, experience of using technology and interaction with social network. These themes also served as the basis of analysis to identify probable patterns, using content analysis (Krippendorff, 2004; Mayring, 2000). Audio-recorded interviews were listened to and transcribed regularly. To help complement the quantitative findings, consistencies were sought. At the same time, deviant responses were carefully recorded and analysed to interpret the variations across the context, an inductive method of analysis often known as a thematic approach. Table 4.3 summarises the methods and materials by specific research questions. In the next three chapters, I will present the findings for each of the research questions.

Table 4.3 Summary of methods and materials

Research Question	Target Population	Data Collection Tools and Techniques
1. Who (population groups) has access to and uses eHealth to access healthcare and information? (who and why)	General population	Who has access and use – quantitative – General population survey (random sampling, n = 854)
		Why (qualitative) – Focus Group Discussion (FGD) with six socio-economic groups
2. How do socio-demographics and technological skills affect use of eHealth to access healthcare and information for group(s) who does so most? (Why do specific groups have higher access to and use of eHealth?)	Young and educated adults (college students)	Quantitative – Survey of college students (random sampling, n = 439)
3. What constitutes skills to be able to use technology for accessing healthcare and information and how does it differ by individuals' perception and actual level? (Exploring skill to access eHealth)		Perceived and observed skill – quantitative – Survey of college students (purposive sampling, n = 60)
		Understanding individual's skill (qualitative) – IDI (purposive sampling, n = 60)

4.4 Ethical Considerations

Ethical approval was sought from the Institutional Review Boards (IRB) of International Centre for Diarrhoeal Disease Research, Bangladesh (icddr,b) for the general population research question one (RQ1), and college student surveys research question two (RQ2). The qualitative part of RQ1 (FGD) and all the purposive surveys and IDI of the college students for RQ3 (eHealth literacy) was conducted with ethical approval from the IRB of the University of Sussex Research Committee. During data collection (both qualitative and quantitative), informed consent was sought from all participants. The consent form was read out clearly to all the participants with required clarification to help them understand the meaning of participation. They were also told about their rights and role in the research process before beginning any interview and assured of their freedom to withdraw themselves from the process whenever they liked. Additionally, they were assured that they were not compelled to answer questions which they perceived to be impolite or sensitive. After The participants were thoroughly informed of the study objectives, its purpose and significance, and the means of data collection including use of tape recorder, significance of data and the intimate nature of questions. After all the explanations and clarifications, and when the participants were comfortable, written affirmation of the consent was sought in the form of signature or thumb print. While taking consent, permission for future use of the data was also sought (secondary analysis).

During data collection, no personal or identifying information was collected, recorded or attached/tagged to any voice-recorder, audio file or anywhere else. Sometimes information came out spontaneously during the course of discussion which could be used to identify the corresponding discussant. Those were erased later especially while transcribing. The recordings were coded with numbers and dates without any identifying points. The audio files, after transcription and translation, will be kept for at least three years in case further verification of the research/data is required.

Chapter 5 | Equity Dimensions of the Use of eHealth to Access Healthcare: Ownership of Devices and Access to and Use of eHealth

This chapter examines the extent to which use and awareness of health information through electronic means is affected by socio-demographic factors such as age, gender, education, SES and personal and household ownership of devices (PC/laptop and/or mobile phones) in a semi-urban community in Bangladesh. My conceptual framework sets out the dynamics and interconnectedness that make owners of mobile phones and laptops use their devices to access electronic health information and/or services. This conceptual framework is primarily inspired by the literature review on the digital divide. The chapter begins by exploring who uses electronic devices to access eHealth (and by extension, healthcare). It also points to the importance of the owners' agency in relation to their use of devices for accessing eHealth. To understand people's reasons for using (and not using) devices to access eHealth and mHealth, I have presented findings from a survey of the general population of Mirzapur regarding their ownership and use of ICT, and a follow up FGD (discussed in Chapter Four). The theory of DOI tells us that a small proportion of owners are expected to use their devices to access eHealth (and mHealth) in rural Bangladesh. Evidence also suggests that they are usually better educated, of higher SES and younger men (Rogers, 2003). I agree with this. But I also think this should be further explored in contexts such as Mirzapur, which are not large cities but rather semi-urban areas of Bangladesh with good road access to larger cities, and thus with reasonable access to technology.

To understand who has access to eHealth (and mHealth), I have analysed the quantitative data for ownership of electronic devices and the quantitative data for the use of devices to both seek information and health services and/or information. These findings were further stratified by demographic factors such as age, gender, education and income. Household and personal ownership of devices (mobile phone or laptop or both) was considered as the proxy for access to electronic platforms. How the use of electronic devices to seek health services and/or information was operationalised is described in the previous chapter (4.3.1). Considering the use of devices for eHealth can be personal,

only owners who have personal devices were included. The distribution of the quantitative data is presented through simple univariate analyses; i.e. measures of central tendency. The differences between the users and non-users of eHealth has been presented in numbers and proportions (%), stratified by age, gender, education, income and ownership of mobile devices. To find out the statistical significance of these differences, the *chi square* test was done between the groups because the variables were non-parametric (categorical) in nature. Quantitative analysis was performed using both STATA version 14 and MS Excel 2016.

The analysis of the FGDs was done to identify the patterns describing the reasons for not using mobile phones and/or PC/laptops to access healthcare and/or information by the participants, using the techniques of content analysis (Krippendorff, 2004; Mayring, 2000). This provided the reasons for not using electronic devices for accessing healthcare. The findings were grouped as three broad themes; a. reasons for not using (my intention was to make a list of reasons), b. awareness (to understand if the participants were aware of such electronic sources) and c. role of intermediaries (asking for help from anyone in the family or peer network to look for health information using electronic devices).

5.1 Socio-demographic Profile of the Participants

In the general population survey, 854 households were interviewed. The participants were aged between 16 to 80 years with near normal distribution, and their mean age was 41.3 (±14.5) years. For the purpose of description, respondents were divided into six age groups: 16-24, 25-34, 35-44, 45-54, 55-64 and 65+ years. This is similar to demographic and health surveys (DHS) and the surveys of Bangladesh Bureau of Statistics (BBS) (NIPORT et al., 2016). About 67% of respondents constituted the adult and middle age groups and the eldest group was the smallest (8.55%). This was later grouped as young adults (14-24 years), adults (25-34 years), middle age (35-54 years) and elderly (≥55 years) for the purpose of analysis. About 72% of the respondents were female, so there were two and a half times as many females as males, with a male-female ratio of 1:2.6. This is because the survey was conducted at households and

during the daytime when males were more likely to be away. About 38% of respondents had no education and about 3% of the respondents were graduates or higher. More than half (58%) of households had four to six household members, with more than two children and/or in-laws as residents. This resembles a usual Bangladeshi family size (NIPORT et al., 2016).

About 73% respondents were reported as unemployed. However, this does not reflect the exact household scenario since most of the respondents were female and housewives. It is very common in Bangladesh for the housewives to be considered unemployed. When asked about the employment status of the household heads, 76% were reported to be in some sort of formal employment. To understand the SES of the sample households, three groups were considered using the SES scores; poor, middle-class and rich. These three SES groups were equally distributed, meaning there were about 33.33% respondents from each. This is to prevent one or two groups ending up with most of the participants. About 96% households had no menial labour as a source of income, indicating households with stable income sources. To support this further, about 93% households had no social security cards. Table 5.1 shows the distribution of socio-demographics of the respondents and their households.

Table 5.1 Socio-demographic profile and ownership of electronic devices of the participants and households in Mirzapur (n = 854)

Socio-demographic traits	Distribution n (%)
Individual	
Age groups	
16-24	97 (11.36)
25-34	215 (25.18)
35-44	190 (22.25)
45-54	169 (19.79)
55-64	110 (12.88)
65+	73 (8.55)
Range: 16-80 years	
Mean (±SD): 41.3 (±14.5) years	
Median: 40 years	
Gender	
Male	240 (28.1)
Female	614 (71.9)
Education	
No Education	327 (38.29)
Primary	206 (24.12)
Secondary	254 (29.74)
Higher Secondary	41 (4.8)
Graduation & Above	26 (3.04)
Household	

Members per household	
1-3	257 (30.09)
4-6	494 (57.85)
7+	103 (12.06)
Respondent employment status	
Yes	229 (26.93)
No	625 (73.07)
Household head working status	
Yes	660 (77.28)
No	194 (22.72)
Socio-economic status (SES) of the household	
Poor	295 (34.54)
Middle	276 (32.32)
Rich	283 (33.14)
Presence of menial labour	
Yes	35 (4.1)
No	819 (95.9)
Household's social security card	
Yes	61 (7.14)
No	719 (92.62)
DK (Do not Know)	2 (0.23)

5.2 Access to Technology; Ownership of Devices

Among the 854 respondents, about 54% mentioned that they had their own personal electronic devices (mobile phones, laptops/computers or both) and about 90% reported having devices at their household. In both cases, ownership was almost exclusively mobile phones with a very small proportion who had both mobile phones and laptop/PCs. This household ownership is similar to that reported in previous studies (Khatun et al., 2014). But personal ownership was much lower. The most recent data regarding personal mobile phone ownership suggests that it stands at about 81% of the total current number of mobile-cellular subscribers in Bangladesh (BTRC, 2017). This includes multiple SIM cards as well (subscription to more than one network). Therefore, the actual number of subscribers is expected to be lower. Table 5.2 shows the distribution (%) of electronic devices at both household and personal level in Mirzapur.

Table 5.2 Distribution (%) of household and personal ownership of electronic devices in Mirzapur (n=854).

Ownership of devices	Percentage n(%)	
	Household	*Personal*
Yes	**771 (90.28)**	**471 (55.2)**
Mobile	751 (87.94)	454 (53.2)
Laptop	2 (0.23)	0
Both	18 (2.11)	17 (2)
No	**83 (9.72)**	**383 (44.8)**

I find that access to technology in Mirzapur is high, especially considering household access. However, this strictly refers to access to mobile-cellular technology. Clearly, access to computer technology is still very low. Also, there is evidence of an access divide in terms of ownership; household vs. personal.

5.3 Access to Technology; Availability of Networks and Related Subscription

The survey also collected information regarding respondents' subscriptions to available telecommunication services and their ownership of SIM cards. Although this is not part of the people's agency, it is part of the structural factors in the conceptual framework; and of the landscape of eHealth and mHealth in Mirzapur, as it represents the opportunities related to access to eHealth. This is because, while many eHealth and mHealth initiatives are available and dependent on mobile -cellular technology. Bangladesh has six mobile network providers and subscribers, all of which were found in Mirzapur. Figure 5.1 shows that the Mirzapur mobile network market is dominated by GrameenPhone (75%) followed by Banglalink (16%), Robi (11%) and Airtel (5%), in terms of use by the respondents who owned personal mobile phones. This also resembles the general market share for these companies, in terms of mobile cellular subscription in Bangladesh (BTRC, 2017).

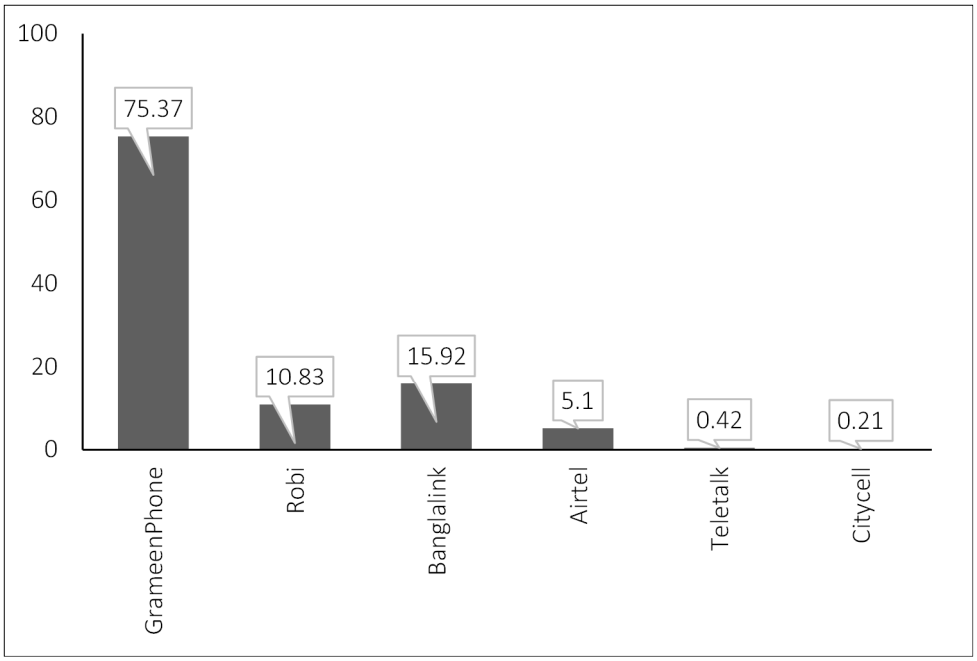


Figure 5.1 Distribution (%) of mobile network subscribers by provider among the personal owners of mobile phones in Mirzapur (n=471)

Further analysis of the influence of socio-demographic traits in relation to network ownership showed no pattern. It is likely that subscription may be subject to various packages that offer greater comfort and freedom for the use of mobile phones (Annexures 1 – 3). For example, the small group of Teletalk subscribers were probably attracted by some offers which was designed for the younger age groups. Respondents were also asked to report on number of subscriptions they have. There was a significant relationship between subscription rates to SIM cards and gender and education. Owning more than one SIM card was found to be higher among males (15%) than females (4%). People with more education have more subscriptions to more than one SIM cards (Table 5.3).

Table 5.3 Distribution (%) of subscription to SIM cards by gender and age, education and SES in Mirzapur (n=471)

Socio-demographic traits	One SIM	More than One SIM
Age		
Young adult (14-24)	51 (86.44)	8 (13.56)
Adult (25-34)	140 (92.11)	12 (7.89)
Middle age (35-54)	168 (93.33)	12 (6.67)
Elderly (≥55)	77 (96.25)	3 (3.75)
P-value	0.188	
Gender*		
Male	141 (85.45)	24 (14.55)
Female	295 (96.41)	11 (3.59)
P-value	0.000	
Education*		
No Education	124 (97.64)	3 (2.36)
Primary	104 (89.66)	12 (10.34)
Secondary	157 (94.58)	9 (5.42)
Higher Secondary	34 (89.47)	4 (10.53)
Graduation & Above	17 (70.83)	7 (29.17)
P-value	0.000	
Socio-economic status (SES)		
Poor	131 (94.9)	7 (5.07)
Middle	124 (91.18)	12 (8.82)
Rich	181 (91.88)	16 (8.12)
P-value	0.441	

Note: * - statistically significant (p value ≤.05)

5.4 Use of Devices by the Personal Owners of Mobile Phones for Accessing Information, Including Health; Access to Electronic Platforms for General and Health Information in Mirzapur

In Mirzapur, owners of mobile phones, laptops or both were found to be familiar with their use for seeking information. Table 5.4 shows that everyone (100%) in the survey with personal devices was found to have sought electronic services and/or information, and voice calling was found to be the main way to do that. After voice calling, SMS messaging and internet were the other means. This means that seeking services and/or information is still predominantly about accessing information through conversation from an official at any relevant organisation or from friends or family. Use of devices reduced greatly when it came to seeking healthcare services and/or information for any health concern, whether serious or not. As shown in Table 5.4, while everyone had used their device to seek some form of information, only 7% sought health services directly and/or health information. This table also shows that the predominant means of seeking information was voice calls, followed by SMS. (Table 5.4).

Table 5.4 Percentage of people who personally owned devices (cell phones, laptops or both) and used or were aware of the use of devices for seeking/exchanging any information and health related information (n=471)

Trait	Distribution (%)
Any Information	
Used and aware	471 (100)
Voice Call*	471 (100)
SMS*	226 (47.98)
Internet*	26 (5.52)
Not used but are aware	0
Health related Information	
Used and aware	34 (7.22)
Any health issues	22 (64.71)
Serious health issues	12 (35.29)
Not used nor aware	34 (7.22)

Use of electronic devices by the people who owned them (personal) was stratified by socio-demographic characteristics: age, sex, education and SES (Figure 5.2). Although overall use was low, the pattern suggests that among those who used their devices, those who were middle-aged (35 to 54 years), female, had little or no education or were poorer people used them less compared to others. The difference in use was found to be significant on Fisher's exact test (p = <0.01).

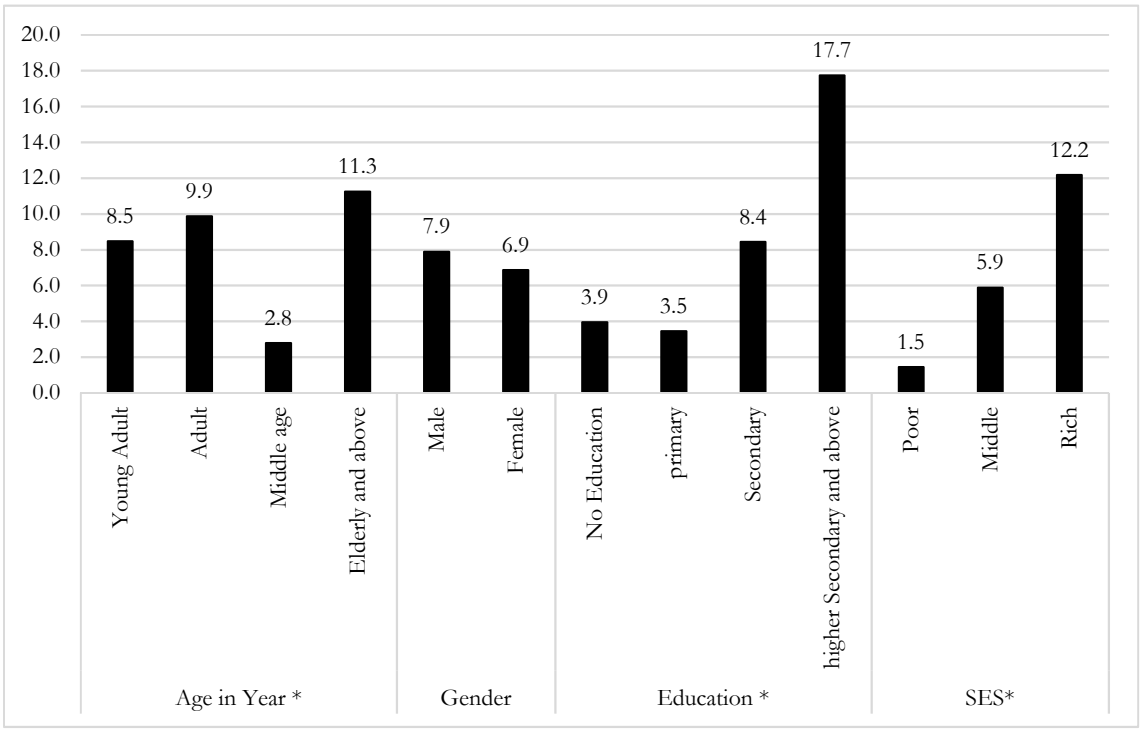


*Figure 5.2 Percentage of personal device owners who sought health information and/or services by age, sex, education and SES in Mirzapur (n=471), *significant at 0.01 level*

5.5 Use of Devices to Access eHealth; Barriers in Mirzapur

During FGDs, participants expressed their reasons for not using electronic devices to access health information and/or services. Almost everyone had accessed some form of electronic information at some point using mobile phones, mostly through voice calls to an office (i.e. local agriculture office or bank) to ask for information. However, despite much promotion (discussed below and in 2.3.1), the provision of electronic health information and/or services, and the words eHealth and mHealth, were unfamiliar to many. One male student stated: *'I have never heard the word eHealth until today. No one told us that one can get health-related information in this way. But sometimes we make calls to some office to know about things. In this way we can get information easily.'* Female students had slightly different views. They preferred to call their friends and/or family for information, as one explained: *'we use mobile phones to talk about many things. If we need to know about something, we call our friends or elders. But I cannot remember if we have ever talked about eHealth'.*

However, many also use mobile phones to seek health-related information despite a lack of familiarity with formal words like eHealth or mHealth. Most of the participants had asked for advice from a family member or from someone who has the relevant know-how. But very few had used their device to seek health information from a formal source, i.e. via internet or a call centre etc. As one of the middle-aged female participants said, *'we are ignorant people, we do not understand all these. Besides we do not need this (eHealth), it's enough if you can receive and make a call using a phone.'* The reasons mentioned by participants in the FGDs for not using their device to seek health information from a formal source can be summarised as: a lack of awareness of eHealth services; personal discomfort and a lack of acceptance; lack of literacy and skills; proximity to health services. Each of these is discussed below.

5.5.1 Awareness of eHealth Services Among the People of Mirzapur

Many participants were not aware of eHealth services. This was surprising given the ongoing promotion of the telecom industry in Bangladesh. A few younger respondents could mention GrameenPhone's health helpline (789), but most of them had little or no understanding of eHealth services. Respondents knew that 789 is a service to call doctors using GrameenPhone mobile phones but

did not know how it worked. The associated cost and how to talk about health ailments also required navigational skills which they did not have (discussed below).

Most of the participants were confused by the promotional activities undertaken by the telecom companies. Mirzapur has an abundance of kiosks and shops which offer a range of mobile phone-related services and products, with colourful banners and posters displaying information about these services. Considering the overflow of information on display, FGD participants found it difficult to distil information related to eHealth services. One of the male participants said: *'the local shops are full of pictures and words about hundreds of offers. Among those, I do not remember any explaining the availability of such type of health service (eHealth). If we cannot find one, how can we be aware that such services exist?'*

The young and educated participants were more aware of eHealth services compared to others. However, even among this group, most did not know much about these services. Some of them also knew about social media-based health initiatives and promotions. Almost everyone had a Facebook account and had seen adverts and information related to health. While Facebook mostly presented information on diet, healthy lifestyles and beauty tips, more serious issues like cancer, HIV and AIDS were also presented on occasion. As one of the female students explained:

> *'We do not know what it is (eHealth) and how can we get health information through it. Or how does it work, how much money it takes etc. Most of us use Facebook or at least have seen it. I sometimes get posts related to beauty or diet-related tips. Sometimes I get information on cancer. But I do not know what eHealth is. I think if eHealth can be made as easy as Facebook, then everyone will come to know about it.'*

5.5.2 eHealth: Personal Comfort and Acceptance Among the People of Mirzapur

During FGDs, respondents (mostly women) expressed specific concerns regarding not knowing the counsellor/provider personally and thereby their hesitance to talk about personal issues and illnesses. One female respondent said: *'we are rural ignorant people. How can we talk about illnesses to someone, whom we do not know or see? We are shy and just cannot do it.'*

Middle-aged respondents expressed their lack of trust in the accuracy and quality of eHealth information and preferred face-to-face interactions with the person providing the information and advice. Almost everyone preferred to discuss healthcare needs with their friends and family first, then with local drug sellers and village doctors before taking their problems to formal medical providers. If someone advised it, only then did they consider seeking health information and/or services electronically. Young and educated respondents were more inclined to use eHealth as they perceived it as ensuring one's confidentiality and privacy. They however had concerns about cost. A young male participant said: *'it takes up money from my mobile account balance. Both internet and talk time are expensive. But it's true that you can say many things over a phone which is rather difficult in a face-to-face consultation with a person whom you know.'*

5.5.3 Use of eHealth: Literacy and Skill of the People of Mirzapur

Some participants mentioned that they lacked the skills needed to access eHealth effectively. This ranged from proficiency in English to technical ability to navigate the device and its software (i.e. specific app, browser, internet settings etc). For example, calling a call centre entails an ability to press specific numbers in response to questions. Or browsing the internet requires English literacy and technical skills to set their devices for internet use. One of the middle-aged participants said: *'it's easier for young people. They know how to do this using their mobile phones or computers. They also have the skills to do that. That's why I do not have internet in my phone.'*

Some young participants also felt that a lack of proficiency in English is a barrier to accessing information and services electronically. One of them mentioned: *'we are Bengali, and Bangla is our language. And we are not very good at English which, in my opinion, is our main problem.'* Some of the young participants mentioned that family members had asked them (or their friends) to look for health information electronically but they never did so for themselves. In this connection, one of the elderly respondents said; *'We are old and that's why we do not know much about this. We can only receive and make calls. Sometimes if someone sends an SMS, we take the phone to the other members of the house to find out what it is. We do the same when we want to know something about the phone.'*

5.5.4 Use of eHealth: Influence of Proximity to the Health Facility

One of the reasons why respondents did not engage with eHealth in Mirzapur was the availability of and access to conventional, formal health services within their vicinity. Mirzapur has an Upazila (sub-district) Health Complex and a philanthropic hospital (Kumudini). For any medical emergency, anyone can visit these hospitals instead of using a call centre or other eHealth services. During discussions, participants agreed that it can be one of the reasons for their reluctance to use eHealth services including information. One of the middle-aged participants mentioned: *'Kumudini hospital was established long time ago and is just beside our house. It is much easier and more comfortable for us to visit this hospital when needed. Besides we also have the Upazila hospital.'*

5.6 Discussion

This chapter began by asking: who has access to eHealth, and what are the implications of this for health equity? In addressing this, it focuses on the degree to which ICTs have enabled Bangladeshi people to increase their access to information and improve their wellbeing. It explores the factors that influence whether people have access to electronic devices (namely mobile phones and/or PC/laptop) and whether they use these devices to access health services and/or information. Findings show that although there is high household ownership (90%) of mobile phones, personal ownership is lower (55%). Everyone who owned a personal mobile phone used it to seek information and services electronically, but only a small proportion (7%) used it to seek health-related information and/or services. While the data suggested younger men and those with a higher education and higher SES chose to use their devices to access eHealth, statistically there is little evidence that socio-demographic factors influenced use of eHealth. According to the FGD findings, non-use of devices to seek health-related information and/or services is connected to: perception of eHealth as an unfamiliar healthcare-seeking model; a lack of technological skills and related literacy to seek electronic information and/or services; associated cost of

accessing information; a lack of awareness about eHealth services; and, proximity to functioning health centres.

In the context of rural Bangladesh, previous works have reported slightly lower household ownership of mobile phones than in urban areas, but with an upward trend (GSMA Intelligence, 2014; Khatun et al., 2014; Tran et al., 2015). The data reported in this paper were collected later than the surveys on mobile phone usage in rural Bangladesh and in a semi-urban context (Mirzapur), which is adjacent to Dhaka. Mirzapur is thus likely to have greater access to technology and resources compared to rural Bangladesh. The high ownership of electronic devices found in this chapter is consistent with what others have reported. However, if ownership of devices is used as a proxy for access to digital technology, it should be noted that the data show that only about half of the respondents have personal devices. There is a wealth of evidence regarding household ownership and use of mobile devices in Bangladesh, showing that high household ownership and subscription to mobile-cellular networks means high access to technology. There is, however, a dearth of evidence regarding personal ownership and use of mobile phones in Bangladesh. Both personal and household ownership need, however, to be reconsidered and explored further in relation to eHealth.

The data also show that only 7% owners have used their phones to access eHealth for health services and/or information. In the rural context, the use of devices to access eHealth has been reported to be even lower (2%) (Khatun et al., 2014). The difference in the spread of technology according to context (semi-urban versus rural) and relatedly. access may account for this variation. However, such low use of devices generally to access eHealth does not indicate that everyone is unable to access services and/or information digitally. In line with these findings, globally (and in Bangladesh, too) male, young, educated and wealthier groups are more likely to use their electronic devices to seek general information and health information and/or services (Acılar, 2011; GSMA & GCWGD Alliance, 2015; Khan et al., 2015; Shah & Jaisinghani, 2014). A recently published paper, based on the findings from Mirzapur, reported that use of mobile phones to access health information at least once in the last 12 months was at 45% amongst college students (young and educated adults) compared to 18% in the general population.

It also reported that internet users were predominantly (two-thirds) male phone owners (Waldman et al., 2018). Therefore, this paper strongly argues that any attempt to integrate technology in the health systems of Bangladesh (and similar contexts) and to endorse related digital health innovations must take into account socio-demographic attributes and the fact that services are more likely to be accessed by the young, the educated and men. While this represents a potential disparity in access to eHealth, it also positions young and educated people to help the diffusion of technology in the community (change agents), and therefore paves the way towards the much discussed and desired integration of technology into the health system to meet the challenges of UHC in Bangladesh (Adams et al., 2013).

The other reasons for the low uptake of eHealth include a lack of awareness about eHealth in terms of its structure and availability, a lack of personal comfort and acceptance of this form of health service or information, a lack of literacy and skill for using eHealth technology and the proximity of other health facilities which provide emergency care. These reasons are not however mutually exclusive and the connections within and between them must be interrogated further in terms of underlying equity challenges. Awareness regarding eHealth initiatives is possibly the most basic of these reasons, yet communicating eHealth potential is not, as discussed above, straightforward. Many middle-aged residents have access to household resources and relevant educational achievements (Table 5.1) that would make accessing eHealth possible, but they are not sufficiently informed, do not have the technological skills (Table 5.4) and they are simultaneously disinclined to pursue health services and/or information provided in this manner because they are unfamiliar with and do not trust, the mode of delivery. Moreover, should they or their family members have a health need, particularly an urgent or emergency one, they would be able to access Mirzapur's other health facilities. Young people, by contrast, are aware of the potential of eHealth, and have the relevant skills and literary sophistication required (Table 5.1). As others have pointed out, they do not however have the material resources and influence that would support and facilitate accessing eHealth, i.e. financial resources or decision-making capacity in healthcare need for example. (Waldman et al., 2018). As a result, they tend to use this service when, as shown above, older people who have the necessary resources request that young people help them to engage with eHealth

services and/or information or when desiring privacy. Young people, like older generations, have access to Mirzapur health facilities when emergencies necessitate this, however, as a recent paper indicates and the discussion above points out, their primary health concerns are often private, non-urgent and often deemed unnecessary, such that their concerns are dismissed, and they are treated with disrespect (Waldman et al., 2018).

There is high awareness and use of electronic devices to access electronic information and/or services across various socio-demographic categories in Bangladesh. Global trends show that in contexts such as this, access to the use of mobile phones and/or computers is expanding (Aker & Mbiti, 2010; GSMA Intelligence, 2014). Yet Mirzapur's respondents continued to avoid eHealth initiatives. Why? The only paper that has tried to explain the reason for such low use in Bangladesh concludes that while the community has some technological readiness and will to use mHealth, a lack of adequate human resources and technological abilities may have restricted the use of electronic devices for health services and/or information (Khatun et al., 2015).

The answer is, however, more complicated, lying partly in how technology interfaces with other social determinants of health to produce equity and inequity. Shankardass, Lofters, Kirst, & Quiñonez (2012) argue that health inequities are caused by complex social, economic and political factors, i.e. influence of gatekeepers, affordability of services, provision of quality healthcare, strategies to secure poor and vulnerable groups' access to health etc. These factors limit recognition of the need for and creation of pro-equity policies. eHealth promises to address access to health services and/or information (Phua, Sheikh, Tang, & Lin, 2015) and, in demonstrating substantial growth in technological access, it gives the impression that challenges in access to health services and/or information are being addressed leading to a decrease in the digital divide. The answer also lies partly in the nature of the users and their skills, knowledge and opportunities. This chapter shows that the universal access to technology approach obscures the ways in which inequity in access to health play out. As Embrett & Randall (2014) argue, addressing health inequity is dependent on generating public awareness, in order to develop sufficient political incentives for change. Yet, the lack of access to health services and health information that, for

instance, young people experience is not socially acknowledged. eHealth offers some potential to address this challenge, with young people having appropriate awareness, sufficient skills, education and literacy that would make this an attractive option, but they lack the English language sophistication required to articulate health needs and use and they do not have the necessary resources to turn this into a reality.

The conceptual framework (Figure 3.3) used in this research sets out the importance of agency (personal and social), structural factors and ownership of technology as important factors shaping people's access to health information and services through online means. This chapter informs us that in a context with widespread availability of eHealth initiatives and people with high access to technology (ownership), use of technology to access healthcare and information is related to individual agency which, in turn, is shaped by socio-demographics. The larger implication of this is that, when technology-based health initiatives are available, young and educated adults have a higher possibility for using such initiatives. The reason for this is the higher technology skill of this group. Thus, the equity implication of eHealth is that certain groups of a population are socio-demographically and technologically disadvantaged in relation to accessing healthcare through electronic platforms and online-based health information. But, based on the conceptual framework, this poses further concerns:

a. If the family members of the young and educated groups had sought help, the use of eHealth services would have been higher. Why did they not do so?
b. b, If the importance of young and educated groups is their technology skill, does this mean every educated young person who has access to technology will use eHealth services? If not, then what is their perception of using technology to access healthcare and information?

The conceptual framework considers technology skill as personal agency. Perhaps it is worth exploring the technology skills and related perceptions of educated young people further to see how it shapes their eHealth literacy and, by extension, their use of eHealth services. We have to keep in mind that addressing inequity in eHealth is not merely the combination of device ownership and the technical skill needed to operate these devices. Rather it is a combination of general health literacy, phone ownership, material resources and technical skill, as well as social recognition of health needs and of

inequity. The conceptual framework was right in pointing out that individual agencies, like age and education, are important factors for people with access to technology (owners of devices) with regard to the use of electronic platforms to access healthcare and related information. However, it inadequately presents the features of technology skill and how this is related to the use of technology to access eHealth. Therefore, to clarify the conceptual framework further, in the next chapter I will present evidence and discuss the features of technology skill, and related perceptions of young and educated people, to explore their use of technology to access eHealth services.

Chapter 6 | Access to eHealth by the Young and Educated Adults of Mirzapur

The conceptual framework (Figure 3.3) of this thesis shows that socio-demographic attributes of the owners of electronic devices can influence their use for accessing healthcare. Findings from Chapter Five show how access to health information and services through digital means is related to age and education. They showed that among device owners, young and educated adults have used them to access information and on rare occasions, health information and services. Chapter Five also adds that young and educated adults in the households have helped other population groups (in this case elderly) to use electronic devices to access health information and/or services. According to the theory of DOI, they are the ideal case of 'early adopters'. According to the theory, they are the advanced user group who are part of the complex social process of diffusion through interpersonal and mediated communication with other population groups and are first to adapt to the changing context (Dearing & Cox, 2018; Mehmood, Barbieri, & Bonchi, 2016; Rice, 2017; Rogers, 2003, p. 34; Weil, 2018). However, the question remains: is it only the socio-demographic attributes that determines if a population group can adopt innovation? Chapter Five (and evidence in Chapters Two and Three) suggests that there are other attributes that help a group to become more open to innovations, i.e. technological skill and knowledge, and using devices for a purpose. In this chapter, I examine the access to and use of electronic platforms for health information and services by the young and educated adults of Mirzapur by their socio-demographic group and skill. This will help us to explain the dimensions of agency as mentioned in the conceptual framework to understand the use of eHealth to access healthcare and information.

Discussion about the popularity of ICT among younger and educated groups has been explored in both developed and developing contexts. Considering their skills in using social networks and the internet, and their interest in ICT, young students have been described as trail blazers who have the potential to use eHealth to promote healthy life-styles (Gross & Latham, 2012; Guraya, 2016; Kaarakainen, Kivinen, & Kaarakainen, 2017; Stellefson et al., 2011; Waldman et al., 2018). In the USA,

smartphones and the internet are believed to be an effective tool to promote healthy and risk-reducing behaviour among younger people (Stellefson et al., 2015). Another study among the students of UK universities (mean age 23.8 years) reported that young educated adults are the early adopters of smartphone and digital technologies and that they should be considered an important population group for various health promotional interventions (Dennison, Morrison, Conway, & Yardley, 2013). To describe the role of mobile phones in health behaviour interventions, a systematic review suggested that young students are similarly important (Buhi et al., 2012). Young people are also more inclined to use health apps on smartphones (Cho, Park, & Lee, 2014). A Korean study reported that 92% of the younger population own smartphones, and internet use among them is at 100% (Ministry of Science, 2013). It was also reported that young educated Koreans were more skilled in using eHealth services and more conscious about health compared to the older population (Cho et al., 2014). Considering the potential of young adults in using ICT-based services, many European countries devised a range of direct and supported interventions particularly targeting this group as early as the beginning of this century (Zinnbauer, 2007). A study of secondary school students in rural and urban Finland reported positive attitudes and increased knowledge on how to evaluate the quality of the electronic information (Räihä, Tossavainen, Enkenberg, & Turunen, 2014).

Typically, youth are more globalised these days and have more opportunity for education and exposure to ICT solutions compared to older generations; and developing countries are no exception (Halewood & Kenny, 2008). As in developed countries, the younger population are more equipped and inclined towards ICT and its use for health compared to the older population (Henriquez-Camacho, Losa, Miranda, & Cheyne, 2014). To document the use and associated skills and competencies required to navigate media (including electronic platforms) for health information among young Senegalese adults, a study reported much interest and willingness among the group. According to Glik et al., (2016), both new and old media-based initiatives and related strategies are needed, and there is a need to address the health needs of youth in media content in order to further develop their associated literacy and the quality of information available (including via electronic platforms). The importance of ICT in communicating

HIV and AIDS messages among the youth in Uganda has resulted into number of eHealth and mHealth initiatives. ICT was also the primary tool in initiating political and civil movements as depicted by the Arab Spring (Edouard, Edouard, & Edouard, 2012). The growing popularity of ICT among the youth as a means to participate in civic and political activities in Asia has also been reported (Zhang & Lallana, 2013). A study of urban slums of India explained the anthropological perspectives of growing interest and use of mobile internet among youth (Rangaswamy & Cutrell, 2012). The spread of ICT (including mobile phones and internet) has long been considered necessary for increased access to knowledge and information, employment and opportunities for participation, especially for youth in LMIC and has resulted into a range of innovations and initiatives (Halewood & Kenny, 2008). Mobile phones and the internet have been described as essential and popular tools for engaging in day-to-day entertainment and social networking by Indian youth (Ilavarasan, 2013). In Malaysia, youth are using online platforms like *YouTube, EngageMedia,* and *Myspace* as platforms for raising their voice on issues which are otherwise considered to be socially taboo, such as homosexuality, *Orang Asli* (original or first people in Malay) and their rights, and ethnic discrimination (Lim, 2013).

ICT platforms and the internet are also very popular among the younger generation in Bangladesh. A recent study has shown how mobile phones and the internet is influencing the political attitude and behaviour of young Bangladeshis. The study concluded that such interest by the young may not result in decision-making but has potential to influence the policy-making process in the future (Ullah, 2013). Studies have shown that young and educated males from better-off families in rural Bangladesh are more knowledgeable than poorer families and women regarding the current eHealth initiatives in the country (Khatun et al., 2015; Khatun et al., 2014).

However, what we do not know is, what makes the young and educated adults of Bangladesh such advanced users. Clearly this age group has much potential to promote the use eHealth for equitable access to healthcare. But without proper understanding of the process, they may not be able to become the change agent for eHealth. In this chapter, I have explained the agency of college students who represent the young and educated groups of Mirzapur in relation to their use of eHealth for health

purposes. The assumption is they have the right socio-demographic profile. Do they have the optimum or right skill that is required to use eHealth to access healthcare?

6.1 Context and Operationalisation of Concepts

In Chapter Five, I concluded that socio-demographic agency plays an important role and skill to handle technology/device can be another important agency in influencing access to eHealth. This chapter picks up from there and explores how agency (socio-demographic factors, ownership of and ability/skill to use electronic devices) is influencing access to/use of eHealth services by young and educated adults of Mirzapur. Considering the college students to be representative of young and educated adults, I have explored this in four steps: a. college students' ownership of devices, b. college students' technology skill to operate these devices, c. college students' use of eHealth to access healthcare and d. the influence of socio-demographic characteristics over the use of eHealth by the college students. For this chapter, it is important to understand that the context do not only is refer to the semi-urban characteristics of Mirzapur or the SES of the college students. It also refers to the availability of health call centres, web-based health information sites (i.e. formal web pages of various institutions, internet- and/or call centre-based counselling services), and SMS-based services for receiving and/or sending health-related information (i.e. conveying health status, receiving advice, making complaints etc.). The assumption of this chapter is that college students of Mirzapur have used or helped others to use eHealth to access healthcare (information and/or services) because they have digital access and the relevant technical ability. Access has been operationalised as ownership of devices and the ability to use the devices. Both personal and household ownership of devices (mobile phone and/or laptop/computer) have been considered. Ability to use these devices was described in two ways:

a. hardware skills i.e. device-based (navigating the device; changing ringtones, wallpaper, music etc.), SMS-based (sending and receiving via SMS), use of services (able to send or receive

money through mobile phones), social networking (or, as it is called in Mirzapur, Facebooking) and video conferencing (skype) and

b. interpretive skills, i.e. the ability to read SMS messages alone or with someone's help

Students with high skill and ownership of devices (both household and personal), were then cross tabulated by their use of eHealth for information and services. Figure 6.1 shows the analytical schematics of this chapter.

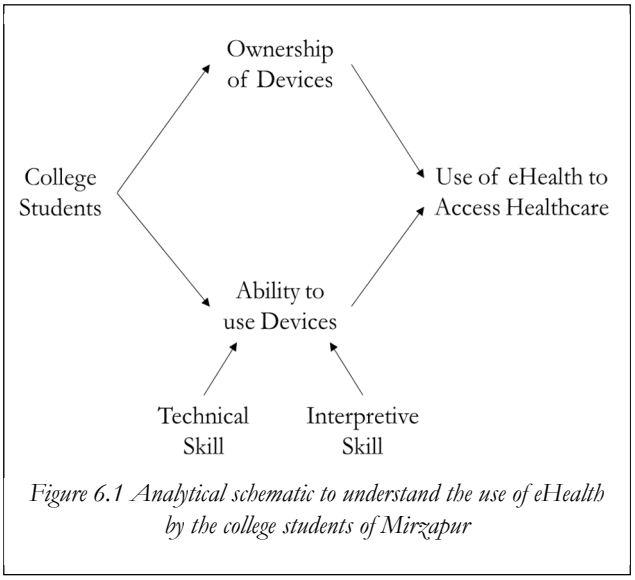


Figure 6.1 Analytical schematic to understand the use of eHealth by the college students of Mirzapur

Finally, to understand the relation of socio-demographic characteristics, both access and use was stratified by gender and SES. In this analysis, age and education were not considered because, socio-demographically, as college students, all participants belonged to the category of young and educated adults.

6.2 Socio-demographic Profile of the Participant College Students

Table 6.1 Age, gender and SES distribution of all participants (n=439)

Age			
	Mean (±SD)	Median	Range
Total	20.5 (±1.8)	20	17-28
Male	20.8 (±1.9)	20	17-27
Female	20.2 (±1.7)	20	17-28
Education (academic programme)			
	Total (%)	Male (%)	Female (%)
HSC/Diploma	2 (0.46)	1 (50.0)	1 (50.0)
Bachelor	434 (98.86)	216 (49.8)	218 (50.2)
Masters	3 (0.68)	1 (33.3)	2 (66.7)
P-value		0.851	
Socio-economic Status (SES)			
	Total	Male	Female
Poor	143 (32.6)	87 (59.2)	60 (40.8)
Middle	144 (32.8)	68 (46.6)	78 (53.4)
Rich	152 (34.6)	63 (43.2)	83 (56.8)
P-value		0.015	

In Mirzapur, 439 college students were surveyed. The mean age of the respondents was 20.5 (±1.8) ranging from 17 to 28 years. Half of the respondents were aged 20 years. About 99% of respondents were students of Bachelor programmes at various years of academic study. The distribution was divided into five socio-economic classes, quintile-wise: poorest, poor, middle, rich and richest. It was later regrouped into three: poor, middle-class and rich, which gave more participants for each SES groups compared to previous five categories. When looked at by gender, both male and female students had similar age distribution in terms of mean, median and range. It was also similar education-wise except that two female students were from master's programmes compared to only one male student. But in terms of SES, male and female students had different distributions. Most of the male students were from poor households while most of the female students were from rich households. For categories of education (academic programme), differences between male and female groups were not significant on non-parametric measures. Table 6.1 shows the age, gender and SES distribution of the respondents.

About 85% (375) of respondents were unmarried. Of the married respondents, four-fifths were female (married male: female = 1:4.8). A majority of respondents (67.65%) were living at the family home with their parents. About a quarter (23.92%) were living in private accommodation i.e. hostels or privately arranged dormitories. About 7%, all of whom were female, were living at their in-laws' houses. About 68% of respondents' households had four to six members who lived or ate together, resembling the average household size in Bangladesh (BBS, 2013; NIPORT et al., 2016). This was followed by households of one to three members (about 16%) and households of seven to nine members (about 13%). Only 3% of respondents had more than 10 household members. There was not much difference between male and female respondents or among the SES groups in distribution of household members. About 32% of respondents mentioned that they were earning and/or had worked in the last 12 months to earn money. Male respondents were found to do more income-generating activities and more of them had worked in the last 12 months compared to the female respondents (male 64.1%, female 36%). About 32% of respondents mentioned that they had an occupation. Among them, 64% were male and 36%

were female. Among the list of occupations, 19% of respondents reported that they were house tutors[5]. When looked at gender-wise, this percentage was high for both male and female respondents. This is a common practice as a means for students to earn money in both rural and urban Bangladesh. Table 6.2 shows the distribution of marital status, household and employment in detail.

Table 6.2 Distribution of marital status, household characteristics and income activity by total, gender and SES (n=439)

	Total	By Gender		By SES		
		Male	Female	Poor	Middle	Rich
Marital Status						
Unmarried	375 (85.42)	207 (55.2)	168 (44.8)			
Married	64 (14.58)	11 (17.2)	53 (82.8)			
P-value		0				
Place of Residence						
Family home with parents	297 (67.65)	127 (42.8)	170 (57.2)	90 (30.3)	104 (35.0)	103 (34.7)
Relative's or friend's home	8 (1.82)	5 (62.5)	3 (37.5)	3 (37.5)	3 (37.5)	2 (25.0)
In-law's home	29 (6.61)	0 (0)	29 (100)	3 (10.3)	10 (34.5)	16 (55.2)
Private accommodation	105 (23.92)	86 (81.9)	19 (18.1)	51 (48.6)	29 (27.6)	25 (23.8)
P-value		0.0			0.001	
Number of people live/eat together at the household						
1-3	69 (15.72)	38 (55.1)	31 (44.9)	25 (36.2)	24 (34.8)	20 (29.0)
4-6	298 (67.88)	146 (49)	152 (51)	100 (33.6)	93 (31.2)	105 (35.2)
7-9	57 (12.98)	26 (45.6)	31 (54.4)	17 (29.8)	25 (43.9)	15 (26.3)
10+	15 (3.42)	8 (53.3)	7 (46.7)	5 (33.3)	4 (26.7)	6 (40.0)
P-value		0.725			0.598	
Currently involved in income generating activities and/or was in last 12 months						
Yes	142 (32.35)	91 (64.1)	51 (35.9)			
No	297 (67.65)	127 (42.8)	170 (57.2)			
P-value		0.0				
Occupation						
Yes	142 (32.35)	91 (64.08)	51 (35.92)			
Professional	2 (0.46)	2 (100)	0 (0)			
Business	15 (3.42)	13 (86.7)	2 (13.3)			
Factory labour	18 (4.1)	14 (77.8)	4 (22.2)			

[5] A young person, usually from another village or area, from a poor family who migrates to a new place for study or work and starts living at a richer person's house for free (including food). In exchange, the person often tutors the children of the new home. House tutor is known locally as a 'Lodging Master.' Master is the Bangla adaptation of teacher.

Semi-skilled labour	16 (3.64)	11 (68.8)	5 (31.3)
Unskilled labour	2 (0.46)	2 (100)	0 (0)
Tutoring	84 (19.13)	45 (53.6)	39 (46.4)
Data entry and collection	1 (0.23)	1 (100)	0 (0)
Electronics / computing	1 (0.23)	1 (100)	0 (0)
Other	1 (0.23)	0 (0)	1 (100)
Working in a shop	1 (0.23)	1 (100)	0 (0)
Working in other business	1 (0.23)	1 (100)	0 (0)
P-value		0.123	

6.3 Access to Devices; Ownership of Mobile Phones and/or Laptops/PCs of the College Student Participants

In Mirzapur, about 66% of college students own personal mobile phones and 27% have both personal mobile phones and laptops/PCs. Both male and female students had the same proportion of personal mobiles; however, ownership of both personal mobile phones and laptops/PCs was higher among male students (male 58% and female 42%) and this difference was significant in *Fisher's exact test.* In terms of SES, the proportion that only owned personal mobile phones was highest among the poor group (42.4%) and lowest among the rich (19.1%). This is because the rich had the highest ownership of both personal mobile phones and laptops/PCs (71.8%) and laptop/PC ownership was lowest among the poor (12%). In fact, the ownership of computers and laptops showed a clear pattern of high to low from rich to poor and ownership of personal mobiles was the opposite. This pattern was also found to statistically significant on *Fisher's exact test.* The personal and household ownership of mobile phones only showed a pattern of high to low from poorest to richest, and the pattern for both mobile phones and laptops/PCs was high to low from richest to poorest. These patterns were also statistically significant. Table 6.3 shows the distribution of personal and household ownership of devices in Mirzapur.

Table 6.3 Actual and proportional distribution of personal and household ownership of mobile phones and both mobile phones and laptop/PC in Mirzapur (n=439)

	Total	By Gender		By SES		
		Male	Female	Poor	Middle	Rich
Personal ownership of devices						
Mobile	288 (65.6)	148 (51.4)	140 (48.6)	122 (42.4)	111 (38.5)	55 (19.1)
Both**	117 (26.65)	68 (58.1)	49 (41.9)	14 (12.0)	19 (16,2)	84 (71.8)
No	34 (7.74)	2 (5.9)	32 (94.1)	11 (32.4)	16 (47.1)	7 (20.6)
P-value		0.000			0.000*	
Household ownership of devices						
Mobile	280 (63.78)	139 (49.6)	141 (50.4)	115 (41.1)	105 (37.5)	60 (21.4)
Both**	119 (27.11)	66 (55.5)	53 (44.5)	12 (10.1)	21 (17.7)	86 (72.2)
No	40 (9.11)	13 (32.5)	27 (67.5)	20 (50.0)	20 (50.0)	0 (0.0)
P-value		0.043*			0.000*	
Any ownership of devices						
Mobile	308 (70.16)	149 (48.4)	159 (51.6)	129 (41.9)	119 (38.6)	60 (19.5)
Both**	122 (27.79)	69 (56.6)	53 (43.4)	14 (11.5)	22 (18.0)	86 (70.5)
No	9 (2.05)	0 (0)	9 (100)	4 (44.4)	5 (55.6)	0 (0.0)
P-value		0.002			0.0000	

(*) P-value statistically significant, (**) ownership of both mobile phones and laptop/pc

About 92% (405) of the college students had their own (personal) mobile phones. Of those, 53% were male and 47% were female. Among those who did not own a mobile phone, about 94% were female students. This pronounced gender divide was found statistically significant on *Fisher's exact test.* This means female students are more likely not to have personal phones. Socio-demographically, a higher proportion of poorer students do not have personal mobile phones compared to richer groups. However, the SES distribution of personal mobile phone ownership was not statistically significant on *chi-square.* To understand personal ownership more, the respondents were asked about the type of phone they owned. Among those who had their own phone, about 52% owned smartphones, followed by feature phones (46%) and basic phones (8%). Statistically (according to *chi-square* testing*)*, male students owned more (60%) smartphones than the female students (40%) and it was almost the same for basic phone ownership (male 47%, female 53%). When looked at by SES categories, richer students had a higher proportion of smartphones compared to the poorer groups. The pattern was not very distinctive for basic phones, but it was somewhat suggestive for feature phones, namely that poorer groups had a higher

proportion compared to richer groups. In Mirzapur, access to a personal phone (or getting one's own phone) happened sometime between late teens to early adulthood (age 16 to 18 years) for 45% of the students with a mean age of 15.9 (±2.5) years. Also, about 30% stated that they started owning their personal phone in their early teens (age 13-15 years). Gender analysis of the first age of owning a phone showed that male students had access to a personal mobile phone much earlier compared to female students. About 73% of male students owned personal mobile phones before they were 13 years old, compared to 27% of female students. Among those who owned mobile phone at the age of 19 years and more, about 20% were male students compared to 80% female Table 6.4 shows the distribution of mobile phones, type of phone and age at first phone.

Table 6.4 Distribution of personal mobile phone, its type, and age at acquiring first phone in Mirzapur

	Total	**By Gender**		**By SES**		
		Male	**Female**	**Poor**	**Middle**	**Rich**
Personal ownership of mobile phones (n=439)						
Yes	405 (92.26)	216 (53.5)	189 (46.7)	136 (33.6)	130 (32.1)	139 (34.3)
No	34 (7.74)	2 (5.8)	32 (94.1)	11 (32.4)	16 (41.1)	7 (20.5)
P-value		0.000*			0.152	
*Distribution of types of mobile phones among those who owned (n=405)***						
Smartphone	209 (51.6)	125 (59.8)	84 (40.2)	53 (25.4)	72 (34.5)	84 (40.1)
Feature phone	185 (45.68)	91 (49.2)	94 (50.8)	77 (41.6)	54 (29.2)	54 (29.2)
Basic phone	34 (8.4)	16 (47.1)	18 (52.9)	10 (29.4)	11 (32.4)	13 (38.2)
P-value		0.009*			0.043	
Age at first phone (n=405)						
Mean	15.9 (±2.5)					
Median	16					
Range	10-23					
<13	41 (10.12)	30 (73.2)	11 (26.8)	13 (31.7)	12 (29.3)	16 (39.0)
13-15	127 (31.36)	84 (66.1)	43 (33.9)	42 (33.1)	36 (28.4)	49 (38.5)
16-18	183 (45.19)	91 (49.7)	92 (50.3)	64 (35.0)	63 (34.4)	56 (30.6)
19>	54 (13.33)	11 (20.4)	43 (79.6)	17	19	18
P-value		0.000*			0.803	

(*) P-value statistically significant

In order to understand the financial aspect of owning and/or using a mobile phone, the respondents were asked who paid for their phones. The first finding was that there were two main ways

of funding mobile-related expenses for the young educated adults of Mirzapur. About 70% of respondents' costs were met by direct family members (father, brother or sister). About 30% met their mobile expenses by themselves. About 70% of those who paid for their own phone-related expenses were male students. For women who received financial support from the family, sisters (63%) were more likely sources. Differences related to financial support for maintaining phone between male and female students were statistically significant according to *chi-square* testing. The SES categorization of the financial sources did not reveal any specific pattern and was not statistically significant either. Table 6.5 shows the distribution of the funding sources for college students' mobile expenses.

Table 6.5: Distribution of the funding sources for mobile expenses of the college students in Mirzapur (n=405)

	Total	**By Gender**		**By SES**		
		Male	**Female**	**Poor**	**Middle**	**Rich**
Myself	126 (31.1)	88 (69.8)	38 (30.2)	51 (40.5)	41 (32.5)	34 (27.0)
Father	234 (57.8)	125 (53.4)	109 (46.6)	72 (30.8)	81 (34.6)	81 (34.6)
Brother	42 (10.4)	22 (52.4)	20 (47.6)	17 (40.5)	14 (33.3)	11 (26.2)
Sister	8 (2)	3 (37.5)	5 (62.5)	2 (25.0)	2 (25.0)	4 (50.0)
Other Relative	16 (4)	4 (25)	12 (75)	2 (12.5)	6 (37.5)	8 (50.0)
Friend	1 (.2)	1 (100)	0 (0)	1 (100.0)	0	0
Other	43 (10.6)	6 (14)	37 (86.1)	10 (23.3)	14 (32.6)	19 (44.2)
P-value		0*			0.169	

(*) P-value statistically significant

6.4 Access to Devices; Technical Skill of the College Student Participants

To understand skill, five categories were created: device skill (ability to navigate the device; ability to change ringtones, wallpapers, music etc.), SMS skill (for sending and receiving SMS messages), use of services (ability to send or receive money using a mobile phone), social networking skills (using Facebook, WhatsApp, Viber etc.) and video conferencing skills (Skype). Among the respondents who claimed to have access to devices (either personal and/or household), about 89% claimed to have device-related skills and were able to change ringtones, wallpapers, listen to music etc. Male students had higher

skills compared to female students. Similarly, among those who could not perform these skills, about three-quarters were female (76%). About 98% respondents said they could send and receive SMS and those who could not were mostly female students (89%). About 30% of respondents mentioned that they could send and receive money through mobile phones and this time, more female respondents (79%) could do this than male respondents (21%). About 64% of respondents claimed they could use social networks (such as Facebook, WhatsApp, Tango, WeChat, Viber etc.) and males were predominant (66%) in doing so, whereas only a third of female students (34%) claimed competence in this skill. About 12% of respondents were confident in their ability to do video conferencing using Skype and these were mostly male (78%). In every case, SES did not reveal any significant pattern. When *non para-metric tests* (Chi-square or Fisher's exact test) were run, the gender divide regarding these five skills was found to be significant. Table 6.6 shows the actual and proportional distribution of technical skills claimed by college students in Mirzapur.

Table 6.6 Actual and proportional distribution of the technical skills of college students who claimed to have access to devices (either personal and or household) in Mirzapur (n=430).

	Total	**By Gender**		**By SES**		
		Male	**Female**	**Poor**	**Middle**	**Rich**
Technical skill; hardware: able to change ringtone or wallpaper and can listen to music using a mobile phone						
No	46 (10.7)	11 (23.9)	35 (76.1)	16	17	13
Yes	384 (89.3)	207 (53.9)	177 (46.1)	127	124	133
P-value		0.000*			0.670	
Technical skill; SMS: able to send and receive SMS messages using a mobile phone						
No	9 (2.09)	1 (11.1)	8 (88.9)	1 (11.1)	5 (55.6)	3 (33.3)
Yes	421 (97.91)	217 (51.5)	204 (48.5)	142 (33.7)	136 (32.3)	143 (34.0)
P-value		0.0060*			0.233	
Technical skill; use of mobile services: able to send and receive money using a mobile phone						
No	303 (70.47)	191 (63)	112 (37)	89	97	117
Yes	127 (29.53)	27 (21.3)	100 (78.7)	54	44	29
P-value		0.0000*			0.003	
Technical skill; social networking: able to use Facebook, WhatsApp or Tango, WeChat or Viber using a mobile phone						
No	153 (35.58)	35 (22.9)	118 (77.1)	56 (36.6)	57 (37.3)	40 (26.1)
Yes	277 (64.42)	183 (66.1)	94 (33.9)	87 (31.4)	84 (30.3)	106 (38.3)
P-value		0.0000*			0.039	
Technical skill; video conferencing: able to use Skype to video chat using a mobile phone						

No	380 (88.37)	179 (47.1)	201 (52.9)	132 (34.7)	125 (32.9)	123 (32.4)
Yes	50 (11.63)	39 (78)	11 (22)	11 (22.0)	16 (32.0)	23 (46.0)
P-value		0.0000			0.101	

(*) P-value statistically significant

The list of technical skills was then arranged serially:1. hardware, 2. SMS, 3. use of mobile services, 4. social networking and 5. video conferencing. Anyone who had all five or who had four of them was categorised as having high skill. Respondents with two or three skills were categorised as having a medium skill level and those with only one skill were considered to be of low skill. Those with no skills were considered to be a group with no skill. Based on this, about 85% of college students were found to have medium technical skill (two or three skills), about 12% had high skill (four or five skills), about 2% had low skill and about 5% had no skill. There was a significant gender difference among the respondents in terms of skill. Male students had higher skills compared to female students. SES was not found to be related to skill in any way; there was no definitive and significant *(Fisher's exact test)* pattern. Table 6.7 shows the distribution of the skill-based groups among those who had access to devices (ownership).

Table 6.7: Distribution of the technical skill-based groups among college students who had access to devices (both personal and/or household ownership) in Mirzapur (n=430)

Skill Groups	**Total**	**By Gender**		**By SES**		
		Male	**Female**	**Poor**	**Middle**	**Rich**
No	2 (0.47)	0 (0)	2 (100)	1 (50.0)	0 (0)	1 (50.0)
Low	9 (2.09)	2 (22.2)	7 (77.8)	1 (11.1)	6 (66.7)	2 (22.2)
Medium	367 (85.35)	175 (47.7)	192 (52.3)	128 (34.9)	119 (32.4)	120 (32.7)
High	52 (12.09)	41 (78.9)	11 (21.2)	13 (25.0)	16 (30.8)	23 (44.2)
P-value		0.0000*			0.148	

(*) P-value statistically significant

6.5 Access to Devices; Interpretive Skill of the College Student Participants

To explore whether the respondents had the interpretive skills necessary for mobile phone use, their understanding of SMS was used as a proxy. Groups who had access to devices and could understand/interpret SMS by themselves were considered as having high interpretive skill. Those who needed help to understand/interpret SMS were considered to have low interpretive skill. Based on this, about 94% of the respondents were found to have high skill, followed by 5% who had low skill. There

were no significant gender differences in terms of skill categories. However, the pattern suggested that the proportion of female was higher for no skill (83%) and lower for low skill (41%) compared to male students (17% and 59%, respectively). Socio-economic groupings did not reveal any significant pattern among the skill groups. Table 6.8 (below) shows the distribution of various interpretive skill groups among the college students of Mirzapur.

Table 6.8: Distribution of various interpretive skill groups among the college students who had access to electronic devices both at personal and/or household level in Mirzapur (n=430).

Skill Groups	Total	By Gender		By SES		
		Male	Female	Poor	Middle	Rich
No skill	6 (1.4)	1 (16.7)	5 (83.3)	1 (16.7)	4 (66.7)	1 (16.7)
Low	22 (5.12)	13 (59.1)	9 (40.9)	2 (9.1)	9 (40.9)	11 (50.0)
High	402 (93.49)	204 (50.8)	198 (49.3)	140 (34.8)	128 (31.8)	134 (33.3)
P-value		0.198			0.029	

6.6 Use of eHealth by Device Owners by their Technical and Interpretive Skills

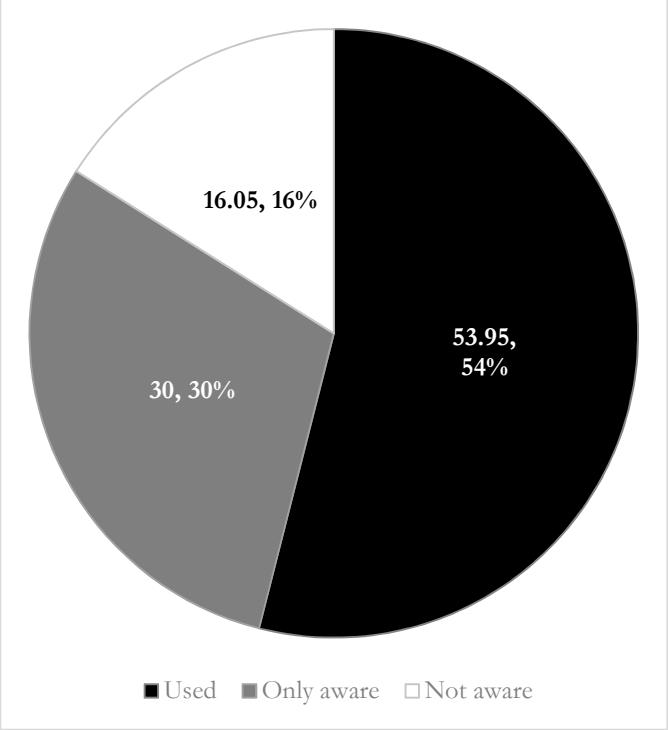


Figure 6.2 Distribution (%) of college students with personal and/or household ownership who used eHealth services, were only aware of them or neither used nor were aware of them, in Mirzapur (n=430).

Use of eHealth services was considered in terms of using voice calls and/or SMS messaging to consult with a call centre or a doctor, and/or browsing the internet for health information and/or services. Among those who owned personal and/or household mobile phones and laptops/PCs, about 54% of the respondents reported using eHealth to seek health information and/or services followed by 30% who did not use eHealth services but were aware of them. About 16% were found to have neither used, nor been aware of eHealth services. Figure 6.2 shows the distribution of

college students with personal and/or household ownership who used eHealth services, were only aware of them, and who neither used, nor were aware of eHealth services in Mirzapur.

To understand how skill is related to the use and/or awareness of eHealth for seeking health information or services, groups were made in relation to both technical and interpretive skill categories (Table 6.7 and 6.8) for all those college students who had access to devices; both personal and household ownership of mobile phone and laptop/PC. Thus 12 groups were made (Table 6.9). The groups were then stratified by their use of eHealth services, by awareness only, and by lack of use or awareness. Findings show that among those who used eHealth services for seeking healthcare, about 81% of them had medium technical skill and high interpretive skill (MH). About 11% had high technical and high interpretive skill (HH) and about 4% had medium technical and low interpretive skill (ML). This means about 85% of the respondents who used eHealth services had medium and about 11% had high technical skill.

Table 6.9 Distribution of skill groups who had access to devices in Mirzapur (n=430).

Skill Group	**Numbers and proportions (%) of skill groups**
HH	49 (11.4)
HL	3 (3)
HN	0 (0)
MH	348 (80.93)
ML	18 (4.19)
MN	1 (0.23)
LH	5 (1.16)
LL	1 (0.23)
LN	3 (0.7)
NH	0 (0)
NL	0 (0)
NN	2 (0.47)

Table 6.9 shows the distribution of use of eHealth services by skill groups. These skill groups were then examined to understand the proportion, within each group, of those who *had used* eHealth, those who were *only aware* of it, and those who *had not used it and were not aware of it*. Among the groups

who had used eHealth the most, HH, MH and ML (), about 63%, 55% and 50% respectively had used eHealth. Among these groups, the use of eHealth services was significantly higher among the male students compared to the female students. This was interesting because often, in Bangladesh and relevant contexts, men are mostly responsible for making health-related decisions. SES categories did not reveal any particular pattern. However, for all the groups, the poorest and richest were found to be the highest users compared to the rest, and it was significant according to *chi-square* testing (Table 6.10).

Table 6.10: Distribution of use of eHealth services by skill groups who had access to devices by gender and socio-economic status in Mirzapur (n=430).

Groups	Used	Aware only	Neither used nor aware	Used eHealth services only				
				By Gender		By SES		
				Male	Female	Poor	Middle	Rich
HH	31 (63.3)	15 (30.6)	3 (6.1)	27 (87.1)	4 (12.9)	9 (29.0)	10 (32.3)	12 (38.7)
HL	0 (0)	3 (100)	0 (0)	-	-	-	-	-
HN	-	-	-	-	-	-	-	-
MH	190 (54.6)	100 (28.7)	58 (16.7)	106 (55.8)	84 (44.2)	83 (43.7)	48 (25.3)	59 (31.0)
ML	9 (50)	9 (50)	0 (0)	6 (66.7)	3 (33.3)	1 (11.1)	3 (33.3)	5 (55.6)
MN	0 (0)	0 (0)	1 (100)	-	-	-	-	-
LH	1 (20)	0 (0)	4 (80)	1 (100)	0 (0)	0 (0)	1 (100)	0 (0)
LL	0 (0)	1 (100)	0 (0)	-	-	-	-	-
LN	1 (33.3)	1 (33.3)	1 (33.3)	0 (0)	1 (100)	0 (0)	1 (100)	0 (0)
NH	-	-	-	-	-	-	-	-
NL	-	-	-	-	-	-	-	-
NN	0 (0)	0 (0)	2 (100)	-	-	-	-	-
P-value		0.000*		0.002*			0.116	

(*) P-value statistically significant

6.7 Discussion

The participant college students were similar to the educated young age group. Similarities include features like a greater proportion of married female students, or a household comprising of four to six members, or tutoring to earn money; these are features very common in rural, urban or semi-urban Bangladesh. Hence, the survey results are representative of young educated adults or college students in Bangladesh (BBS, 2013; NIPORT et al., 2016). High levels (93%) of ownership of mobile phones both personally and by households also correspond to previous studies (Khatun et al., 2014). This survey is

one of the first to report the low penetration of computer technology in the country. It was also found that the current status of computer penetration is slightly biased towards young and educated males, and richer socio-economic groups.

Such evidence of a digital divide should be kept in mind while designing and/or scaling up initiatives which are based on computer technology. Mobile ownership among college students can be described as follows: 14% of female students do not own a phone, compared to <1% of male students (Table 6.4) and 94% of those who did not own mobile phones were female. A skewed gender distribution of mobile phone ownership such as this is not uncommon in many LMIC contexts and is a major concern for ICT4D. Given that many digital divide parameters are gradually becoming blurred due to the huge subscription base, it is time to apply equity parameters over the excluded group(s) for universal access to ICT. The survey results also indicate that young and educated people start using technology at a much earlier age. In Mirzapur, the mean of age of using technology is 16 years and for males it starts earlier than for females. Thus, the survey presents findings from a group which has had about five years of exposure to mobile phones (the mean age of the respondents was 20.5 years). The findings confirm the common idea that younger and educated population groups are, to an extent, tech-savvy (I will detail this in the next chapter). Therefore, this age group is at the forefront of the ICT revolution in Bangladesh and in other similar contexts. Considering the existing gender- and poverty-related digital divide, ICT initiatives should capitalise on this portal of entry for diffusion through society, yet also recognise that this has equity implications.

In Mirzapur, only 8% of college students owned basic phones, which are used only for making calls and texts. The widespread use of smartphones (52%) and feature phones (46%) by this group compared to the distribution of phones in the general population of Mirzapur (Chapter Five) is an indication that young and educated adults are early adopters of the rapid growth of the ICT in the country. Based on observations made during data collection, the rapid spread of mobile phones that are non-brand, cheap and of questionable quality may be the reason for such high penetration of smartphone and feature phones in the country, indicating that financial barriers related to owning high-tech mobile phones

are narrowing (Tran et al., 2015). Given the extent of ownership, there is still evidence of a digital divide with some new parameters like the penetration of high-tech mobile phones. This survey also confirms that in a country like Bangladesh, use (and maintenance) of electronic devices is at least financially tied up with the family and this can be a barrier, as well as offering scope for any mobile phone-related development initiatives. Unfortunately, this financial relationship as individual agency is yet be explored fully as a factor that can facilitate people to enjoy the full potential of ICT solutions. If studied properly, it can help young people to use their devices independently, and/or access family-related development solutions (in this case health).

While ownership of devices has long been considered as a proxy to define access to electronic services, this chapter questions several dimensions of skill and relates them to the use of electronic services. As explained earlier, skill has been conceptualised as technical and interpretive. Skills were then grouped into the following categories: high, medium, low and none. Students were asked questions about their abilities to do related tasks. Therefore, it was a self-evaluation of one's abilities. The findings suggest that the young and educated adults of Mirzapur lack internet-related skills, thus their technical skill was medium (85%). This also reveals that in their current forms, any social networking or video conferencing-based initiatives may fall short of reaching the entire group. Only about 11% indicated that they were in the high skill category for social networking and video conferencing, with male students predominating. It would be useful to critically investigate the features of this 11% to better understand what enabled them to gain these skills. If we want to devise solutions regarding improving eLiteracy and capacity development for the majority of the population, we need to understand the characteristics of all users, both advanced and those demonstrating low or no skills. To understand interpretive skill, the ability interpret SMS messaging was used as a proxy. The respondents were all students and 94% were in the category of high interpretive skill which was expected. While this indicates the importance and popularity of SMS-based initiatives, the lack of high-tech skill and the gender divide warrant further investigation, and specific measures and initiatives are needed to capitalise on the maximum potential of ICT services in the country and elsewhere.

This chapter further confirms that having a huge subscription base may not necessarily mean that people will benefit from available eHealth services. In Mirzapur, while the young and educated adults are the most highly equipped and best educated population, only 54% have used their devices to seek health information and/or services electronically and 30% were aware of health information and services but did not use them. In a setting where telecommunications and network facilities are widely available and where there is a population with moderately high skill levels (both technical and interpretive), the fact that only about half of the population are using eHealth services certainly warrants careful consideration. Further analysis suggests that among those who have used them, a significant proportion (85%) had no internet related skill. Therefore, the use by 54% of this population probably relates to phoning a call centre, using SMS based initiatives and/or general telephone conversations enquiring about health-related ailments and respective suggestions. This further indicates missed opportunities regarding the wealth of information and initiatives that are available on the internet and related platforms.

eHealth has opened an effective way to communicate with the health service providers and provides a sea of information irrespective of geographical barriers; and theoretically it can help people in accessing healthcare. Rapid growth in use by young and educated adults, and their tech-savviness, puts them in a suitable position for adopting the technology and thereby helping to increasing its use by all. In this respect, Mirzapur's college students have the potential to be a game changer in a context like Bangladesh. Unfortunately, there have been no studies which have reported on the use of electronic health information and/or services by young and educated adults in Bangladesh. However, studies have reported low use by the general population (Khatun et al., 2015; Khatun et al., 2014) and this is echoed in Chapter Five. This chapter shows the use of eHealth services by young and educated adults.

The findings in this chapter challenge other available evidence. While the current evidence and the analysis in this chapter point to the importance of young and educated adults of Bangladesh in regard to access to eHealth, it goes further in explaining why that is. Based on my conceptual framework (Figure 3.3), I emphasise peoples' agency to fully understand what determines use of eHealth to access healthcare. In relation to this, Chapter Five highlighted the importance of individual agency relating to age, education

and technology skill to use electronic means to access eHealth services. However, because of the design of the general population survey and FGDs, the analysis in Chapter Five could not provide enough information regarding technology skill. Using the conceptual framework and college student survey, this chapter has explored how technology skill is related to the use of electronic means to access healthcare and related information by the owners of electronic devices (access to technology). However, with regard to this, the following points should be kept in mind:

- *The concept of access to technology should be about more than ownership, subscription and self-assessment of competence.* Understanding access through ownership, subscriptions to networks and self-reported technical and interpretative skills do not reveal the entire complexity. The complex of nature of eHealth initiatives and their diverse capacity requirements can also act as barriers to use. For example, interpretive skill should be more than being able to read SMS messages. Also, the skill that is reported here is basically the response from the respondents. Considering that, one should have a comprehensive measure to assess someone's readiness and competence in accessing eHealth for healthcare.
- *People's skills should be the dominant consideration in the design.* This chapter suggests that young and educated people of Mirzapur are skilful and have grasped ICT to a certain extent. However, they also lack certain skills, especially in relation to the use of internet-based eHealth services. During the literature review (Chapters Two and Three), I found no indications of initiatives being designed in light of consumers' skills. Besides, current skill assessments (including this chapter) do not explore how other dimensions of health can influence ones' ability to use eHealth. I find there is a large gap in the literature in regard to this.
- *Use of eHealth in the context of needing help/facilitation from someone or some other group.* Given the importance of skill, in Mirzapur, individuals and groups do not possess the skills for using eHealth at the same level. People or groups with skill will have more access to technology and will use eHealth more compared to others. This raises questions about the equity implications of eHealth. Therefore, the introduction of eHealth for accessing healthcare could eventually result into

creating new equity dichotomies, such as information-poor and information rich groups, and thereby cause exclusion. The chapter shows that Mirzapur's young and educated adults have the skill and awareness needed to access eHealth. With the advent and rapid spread of technology, targeted initiatives and more suitable and user-friendly eHealth initiatives are needed to enable this group in Bangladesh and similar contexts. This can help the young and educated adults to play the role of the knowledge intermediaries/*apomediaries*[6] and to facilitate the uptake of eHealth innovations in their own households and social network.

This chapter examines research question two: what combinations of personal agency determine the use of eHealth and how do these interact with electronic device ownership and technological skill? The conceptual underpinnings of this investigation, as discussed in Chapter Three and illustrated in Figure 3.3, are that age, gender, education and income – and the ways in which these intersect with technological skill and social networks – are the key features affecting people's ability to access eHealth. In terms of personal agency, this chapter demonstrates that young, educated males are best positioned in relation to eHealth literacy, and that they report high levels of technological skill (or technological readiness). The chapter concludes that most people will not benefit from available eHealth services; even when there is a large subscription base, when all the necessary telecommunications and network facilities are available, and when the population has moderate to high levels of technological skill (both technical and interpretive). This conclusion is surprising and calls into question the assumptions embedded in the conceptual framework. The chapter demonstrates, firstly, that personal agency does not automatically translate into the appropriate ability to access eHealth, not even for those with the most agency. Secondly, it shows that personal agency is interconnected with family relationships and household ownership of mobile phones, particularly in terms of financial affordability and this too influences the ability to use eHealth. Thirdly, and perhaps most importantly, it reveals that the combination of considerable technology skills and appropriate personal agency does not necessarily mean high access to and use of

[6] "Apomediaries are tools and peers standing by to guide consumers to trustworthy information, or adding credibility to information" (Gunther Eysenbach, 2007).

eHealth. This in turn calls into question the nature of technological skill and its role in relation to eHealth literacy and points to the need for a deeper investigation of the kind of skill required to access eHealth. It also suggests that, while personal agency has some impact on people's inclination to use eHealth, other underexplored factors – such as the experience of using technology, experience of using information and financial affordability – may also be of critical importance. These are explored in the following chapter.

Chapter 7 | eHealth Literacy and Associated Skills to Use eHealth Services; Evidence from the Young and Educated Adults of Mirzapur

Chapter Six showed that owning an electronic device (a phone or computer), and having the technical skill to navigate devices is inadequate to ensure people's access to eHealth and mHealth. Considering ownership of devices and technical skills as preconditions, I have discussed in this chapter how various personal/individual factors (agency) constitute skills for using electronic devices to access eHealth, and by extension, healthcare as information and/or services. According to the conceptual framework, these essentially constitute the conversion factor required to convert resources into capabilities and functionings. This is collectively called eHealth Literacy.

For an owner of a phone or computer to be able to use it to access eHealth, there needs to be a social acceptance of healthcare-seeking in that way, as well as technical skill to use a device. Chapter Six demonstrate that while younger people are generally assumed to be more skilful, their access to eHealth was not high even among those who had considerable knowledge of how to use electronic devices. This indicate a complex interaction between one's agency and the resources that enable the owners of electronic devices to access specific care/services, in this case eHealth. This interaction altogether thus constitutes the capability that helps people to choose eHealth to access healthcare and thereby achieve health-related wellbeing. This chapter will explore how the perceptions, preferences and practices among owners of electronic devices influence access to eHealth and mHealth in Mirzapur.

Before we proceed further, the importance of understanding the perceptions, preferences and practices of owners of electronic devices needs to be explained. Chapters Five and Six assume a technology-centred approach to understanding access to eHealth; the availability and affordability of technology and the technical skill to operate it (Gerster & Zimmermann, 2003). The problem with this approach is the use of technology for a specific purpose stems from the assumption that people find technology to be valuable. Thus, it leaves out the possibility of considering context-related decision-making in relation to using a technology for a specific purpose. This chapter explores the assumption

that using of technology for health should be perceived by the community as beneficial for ensuring their wellbeing. This means various individual (or group) agency and resources influence owners' use of devices to access eHealth. Considering this as a people-centred approach, I describe in this chapter how agency and resources are influencing access to eHealth through phones or computers by young and educated people of Mirzapur.

The purpose of the people-centred analytical approach is to extend the understanding of access to eHealth and mHealth beyond technical skill. As the eHealth literacy framework explains, individual agency to access healthcare and information through electronic platforms requires technical skill to navigate devices, a general understanding of electronic information (including that which relates to health) and its quality (authenticity), and interaction with various electronic platforms. In this chapter, I will present findings from interviews with young college students that explored three questions: a. what are the perceived and observed skill levels among college students in Mirzapur in terms of accessing health information and services electronically? b. are there any differences between the perceived and observed eHealth literacy of the college students in Mirzapur in terms of accessing health information and services electronically and why? and c. what are the challenges and opportunities for eHealth literacy given the research findings for college students in Mirzapur? These findings will be presented in tabulated forms, as verbatim accounts and as case studies.

7.1 Participants' Profiles

To understand the state of eHealth literacy among the young educated adults of Mirzapur, 60 students of Mirzapur Degree College (MDC) were interviewed. Of these 41.7% (25) were female and 58.3% (35) were male. The average age of the participants was 20.75 (female 20.24 and male 21.11). About 22% (13) of the respondents could provide their email address. Interestingly, more female students could provide an email address (24%) compared to male students (20%). All the respondents were from undergraduate programmes; about 53.3% were in their second year and both first- and third-year students

each comprised 23.3%. Because the interviews were done in the college setting, it was not possible to understand the SES of the participants. It came up during the discussion, but the discussion was inconclusive, hence a relative decision was made. If a respondent had both a laptop and a smartphone, it was inferred that they came from a well-off family. If someone had a smartphone, it was assumed that they were middle class. Participants with a regular or feature phone were assumed to be relatively poor. Based on these assumptions, most of the respondents were poor (58%), with middle class being the next biggest group (35%) and the smallest group were the rich (7%). Table 7.1 below shows the distribution of the respondents along with female and male specific figures.

Table 7.1: Distribution of the IDI participants: total (n=60), female (n=25) and male (n=35) students.

		All	N=60	Female	n=25	Male	n=35
		Frequency	%	Frequency	%	Frequency	%
Central Tendency (distribution)							
Mean age		20.75		20.24		21.11	
Range	Max	23		22		23	
	Min	18		18		18	
Email		13	21.7	6	24	7	20
Education (all Bachelor)							
	1st Year	14	23.3	5	20	9	25.7
	2nd Year	32	53.3	15	60	17	48.6
	3rd Year	14	23.3	5	20	9	25.7
Relative socio-economic status							
	Rich	4	6.7	2	8	2	5.71
	Middle	21	35.0	11	44	10	28.57
	Poor	35	58.3	12	48	23	65.71

7.2 Access to Technology and Technical Skills: How These Are Related to Accessing eHealth and mHealth

A popular aspect of access to technology concerns technology skill or digital skill. A recently published editorial of The Lancet Child & Adolescent Health mentions that due to a lack of digital skills, 60% of African youth do not have access to digital services compared to 4% in Europe (The Lancet Child & Adolescent Health, 2018). In recent reports, a lack of skill and knowledge of how to access the digital world has been described as a key feature of deprived contexts, resulting into a digital divide (UNICEF, 2017, p. 8; World Bank, 2016). In the digital world, the youth are often perceived to be 'cyberkids'; however, the current literature criticises the concept of the 'digital native' as providing too

positive an image of ICT use by youngsters. In reality, they lack ICT skills ranging from device handling to privacy awareness, legal and ethical use etc. (Centeno, Cullen, Kluzer, & Hache, 2012, p. 7). This also raises questions about skill that have been reported in Chapter Six. In this section, I will first present the young people's perceptions of their own technical skills in using phone and computers, and I will then present the results from their performance of specific tasks, to understand the difference between reported and observed skill.

7.2.1 College Students' Perception of Their Own Technical Skill to Operate Electronic Devices: Claimed Skills

Sixty male and female college students were asked a set of eight questions regarding knowledge and skill relating to electronic platforms and health information. The responses were recorded as a Likert scale and scored as: 'strongly agree' (five), 'agree' (four), neutral (three), 'disagree' (two) and 'strongly disagree' (one). The mean eHEALS score was 25, which was the same for both male and female students. The lowest eHEALS score can be 8 and the highest can be 40. If divided into quintiles, the score 25 falls into the fourth quintile and so does the median score (27). This means that the Mirzapur college students (overall and also male and female, separately) viewed themselves as having high levels of eHealth literacy and can use electronic devices to seek health services and/or information. However, the female students had higher eHealth literacy as a group. The median eHEALS score for female students was higher (29) than the score for male students (26). Range-wise, the maximum score reported by the female students was 38 while it was 36 for male students (Table 7.2).

Table 7.2: Distribution of eHEALS scores for college students in Mirzapur by all (n=60), Male (n=35) and Female (n=25).

Distribution / Participants	Mean	Median	Range	
			Maximum	Minimum
All (N=60)	25	27	38	8
Male (n=35)	25	26	36	8
Female (n=25)	25	29	38	8

When the score was looked at question-by-question, the mean score for all of the eight questions was 3 (Figure 7.1). This means for each question, the perception of the college students regarding their own eHealth literacy was neither high nor low (neutral). The median score for each question suggested that for all the questions, half of all the respondents claimed to have a high score (not highest) which was 4 (agree), except for question 7 ('I can tell high quality from low quality health resources on the internet'). For question 7, half of the respondents settled for 3(neither agree nor disagree). But there was a slight difference between male and female students in terms of their perceptions of their own eHealth literacy. Male students were more confident in making health decisions based on information from the internet (Q8, mean 4) while the female students scored 4 for Q1. The question-by-question median score was 4 for the male college students; half of them perceived themselves to have high eHealth literacy (neutral) except for when it came to questions 4 and 7; the mean score for these was 3 (neither high nor low). For

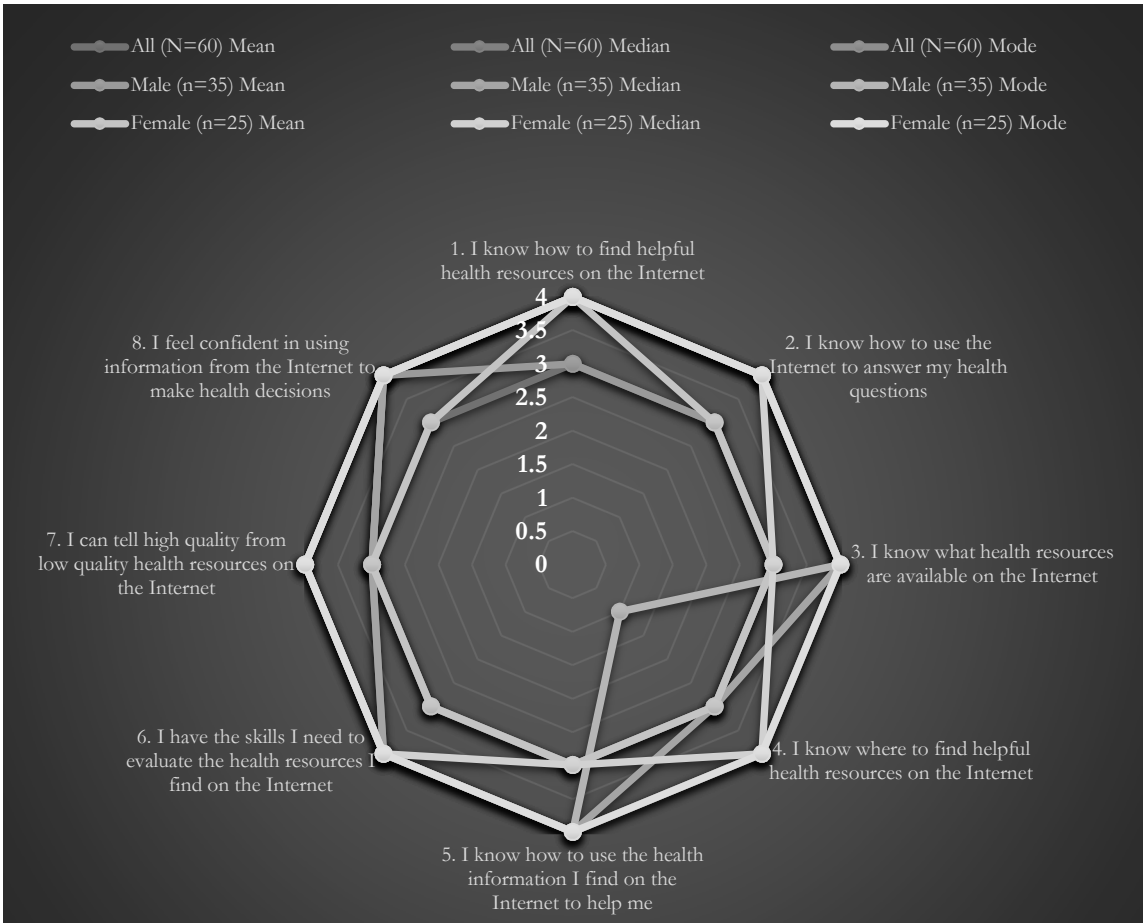


Figure 7.1: Distribution (#) of self-perceived eHEALS scores of the young college students of Mirzapur question by question by All (n=60), Male (n=35) and Female (n=25)

female students, the perception was high for half of the students except for questions 3 and 5, which were 3 (neither high nor low). The most of common mode of response for each question was 4 ('agree') except for the male students for question 4. Half of the male students strongly disagreed that they knew where to find helpful health resources on the internet.

Quantitatively, the distribution of eHEALS scores does not appears to be normal; the distribution is not bell shaped as the results of univariate analysis varies. The main reason for this is probably the sample size and related power. However, it is also important to note that this study was not done from a quantitative point of view. The aim was to document the eHealth literacy of the participants for further exploration and understanding. The findings of the eHEALS suggest that:

a. College students of Mirzapur perceive their eHealth literacy skills to be high. According to the eHEALS range, which is divided into five categories, 1 being lowest and 5 being highest, they perceived that their skill fell into category 4. This supports the general notion that younger generations have a better than average understanding of technology and related skill (Centeno et al., 2012) and hence a high eHealth literacy. This is also consistent with the self-reported skill-related findings in Chapter Six.
b. The analysis also indicates that there is gender differential of eHealth literacy; female students have higher skill compared to male students. However, a growing base of literature mentions that technical skill to access electronic information is still skewed toward male users given the number of socio-cultural barriers, and this results in fewer opportunities for the women. This literature also suggests that in case of school students, boys are more into leisure-related uses of ICT while girls are more into doing homework and sharing ICT access in groups (Dixon et al., 2014; ITU, 2016a; Kaarakainen et al., 2017). eHEALS relates to people's knowledge of eHealth and health is a very important aspect of human life. This may have been the reason for the higher levels of eHealth literacy claimed by the female students.

More on the gender divide in terms of eHEALS was revealed when the scores were looked at question-by-question. For female students, knowledge of health-related resources on the internet and

how to use those resources for better health was reported to be neither low nor high. For male students, knowledge of where to find health resources over internet and of how to assess the quality of those resources was reported to be neither low not high.

Chapter Six, and this section on eHEALS, both present evidence on self-perceived abilities to access technology and electronic health information. There is evidence that self-perception of one's ability to use internet can be different than actual ability. A study conducted in January and February 2014 reported that 66% of Australians have access to multiple electronic devices and perceive that they have high digital skill while only 7% scored as 'very well' when observed performing these skills. Another study of a Swiss population, conducted during spring 2015, reported that 67% participants thought they have good/very good skills whereas only 31% of them could achieve corresponding scores when observed (ECDL Foundation, 2016; Robinson et al., 2015). A study among 100 internet users in New Jersey reported that women tend to report lower skill compared to men whereas both genders had similar web-use skill (Hargittai & Shafer, 2006). If self-perception of skill is different than actual (for this thesis higher), it may mean that people may have less skill to be able to access eHealth but think otherwise. This explains why despite high ownership and considerable skill, access to eHealth has been low among young educated adults (and probably the other population groups as well) in Mirzapur.

7.2.2 Observed Technical Skill of the College Students to Operate Electronic Devices

Participants who took the eHEALS questions were asked to demonstrate the use of a laptop and a mobile phone to browse the internet and social media sites (in this case Facebook), send text messages and talk to a health call centre to seek health information and/or services. This was observed by me and a female research assistant (for female participants) and performance was recorded as *completed, half completed* or *not completed*. However, everyone needed some form of help from me to complete these tasks. The half-completed tasks mean the participants failed to complete the tasks even with help.

Figure 7.2 shows that most of the participants were best at finishing the SMS and call-centre tasks, and were next most successful at using Facebook, or accessing the internet on their phone and

were least successful at accessing the internet on their laptop/computer. 21 participants could use the internet to look for health information and/or services using a phone and only 4 could do the same using a laptop. Proportionally slightly more female students (36%) could use the internet for health using a phone compared to male students (34%). Thirty-four participants could complete the social media (Facebook) task, 54 could use SMS messaging and 50 could use a call centre to look for health information and/or services. Throughout the task performance exercises, there were not many pronounced differences between male and female students. For all students, most of the half-completed task involved using social media, followed by SMS messaging and call centre tasks. The pattern was same for male and female students.

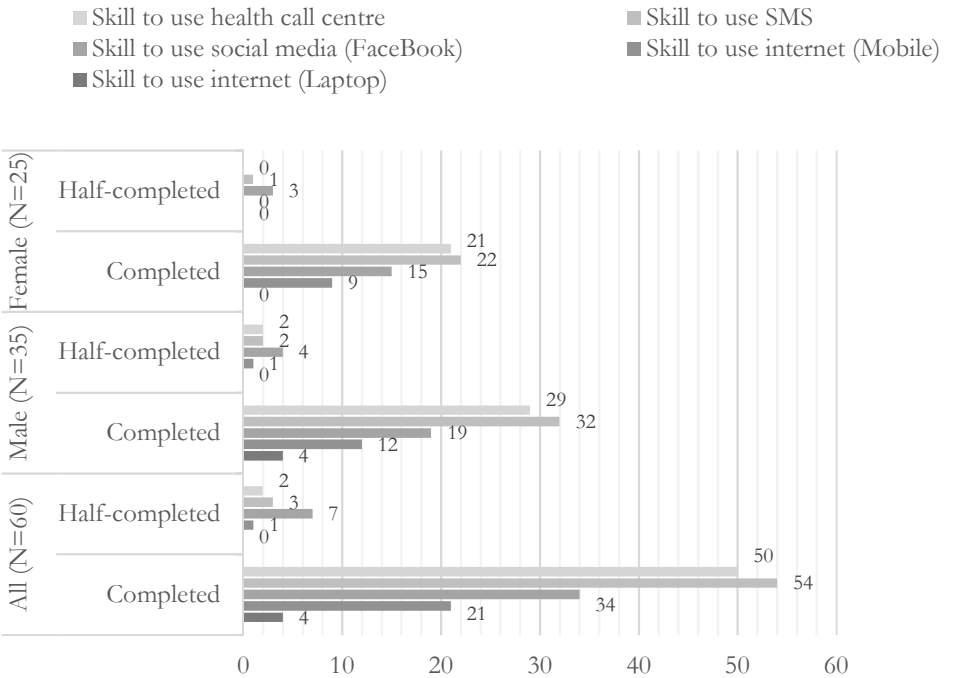


Figure 7.2: Distribution (#) of observed technical skill of the young college students of Mirzapur by All (n=60), Male (n=35) and Female (n=25)

Time taken to perform the internet task(s) ranged from 5 to 15 minutes. Most of the participants did not have their own laptop and were diffident about using the laptop provided during the interview to participate in the task. However, participants were aware of the use of mobile phones for accessing the internet. But as mentioned earlier, almost all of them experienced problems seeking health information and/or services through mobile internet. Typing in English was not easy for them either and

almost everyone typed Bangla in English alphabets and needed help to decide what to type in the search box. In most cases they needed help to enter key words in a search engine and with choosing from the search results. Participants were also confused regarding what to choose from the search list. It seemed that they had little or no understanding of the authenticity of websites. It was difficult for the participants to differentiate between independent and authentic sites or those backed by Google advertisements. Hence, the site that came first or second in the ranking was chosen by most of the participants. Altogether, although about one-third of the participants could complete the task, everyone appeared to be very uncomfortable, hesitant and unsure. For most the main concern about using the internet related to financial constraints.

Most of the participants were familiar with social media, in this case Facebook. But still, many found the task challenging. The participants were not familiar with looking for information through Facebook, therefore finding the desired HIV Facebook page was challenging. Almost everyone could write a comment under a status text or give a like. However, most of the participants did not know how to share a page or suggest a page to their peers (in this case, Facebook friends). During observation, it seemed that HIV was not a comfortable subject for them to share. Nonetheless, social media skills were somewhat satisfactory for most of the participants and female students were slightly more comfortable compared to male students. The overall impression regarding this task was satisfactory if not high.

Figure 7.2 shows that using SMS messaging and making voice calls is the most comfortable use of technology (in this case, using a mobile phone) for the college students of Mirzapur. For everyone, retrieving texts from the inbox, reading and understanding the texts were an easy and familiar task. This was also consistent with the findings presented in Chapters Four and Five, where SMS and voice calls were the two most preferred methods for seeking information. For most of the participants, it was easy to forward a SMS message to their peers, however, only a few knew how to send a group message. Other than this, their SMS skill was high. While making phone calls are easy for the participants, almost all of them were hesitant about to talk about HIV to the call centre agent, who they did not know. Also, almost everyone needed help with the hotline number of the health call centres. This raises a critical question

about the awareness of the eHealth and mHealth services in Bangladesh. Although it seems like everyone knows about the provision (and based on the eHEALS score, claims accordingly), whilst performing the tasks, only a few knew which number to call. Everyone was prompted to use the internet to find the number, but only eight participants attempted and of those three were successful. The overall impression of this task was not satisfactory since they did not know which number to call to.

7.2.3 Access to Technology and Technical Skill of the College Students in Mirzapur to Use Mobile Phones and Computers; Differences Between Perceived and Actual Skill

Mobile-related technical skill seems to be high among young and educated adults of Mirzapur. This includes making voice calls and sending SMS messages. However, their internet-related skill seemed to be mostly related to their use of social media platforms. This also supports the findings for the college student survey which reports that voice calls and SMS were most common ways of seeking health related information and/or service. Laptop-related skills were extremely low among all the participants, especially the female students. And most of them do not have access to laptops, whether their own or one belonging to the household.

The findings also suggest that internet use is relatively low among the participants as a means to seek health information and/or services. It appears that they most favoured reason for using the internet is social media, especially Facebook. The most challenging tasks that involved using the internet were a. making targeted searches through search engines and b. choosing what to select from the search result for desired information. Typing English words was definitely a challenge (possibly due to low English skills), thus almost all attempted typing Bangla word using the English alphabet. Deciding on the search target and choosing appropriate words for health was a major barrier and almost all needed help.

Seeking health information and/or services using SMS was the most comfortable activity for all participants, especially for the male students. The task involved retrieving, reading, understanding and sharing with peers. Most of the participants were found to be comfortable doing that. When using a health call centre, most of the participants could handle the conversation. However, participants were not very aware of the availability of the call centre services. Almost everyone did not know where to call

because they did not know or could not remember the number to call. This suggests that knowing about the existence of services is not enough. In this case, although the services were available, they were inaccessible due a to lack of awareness.

Discussions about digital skills often either focus on the need for technical skill, or reporting people's perceived skill, rather than the gap between perception and actual skill. This section highlights what is probably one of the most least studied areas in the field of technology. There are only few articles and reports that have made an attempt to compare people's perceived and actual technical skills. Most have concluded that males often overestimate - and females often underestimate - their skills (perception) in contrast to their actual technical skill. Also, males and females have distinct purposes for the use of technology and thus their skill varies, too (ECDL Foundation, 2016; Hargittai & Shafer, 2006; Robinson et al., 2015). Findings from Mirzapur suggest that participants' claims regarding own technical skill to use a mobile phone or computer to seek healthcare and information is higher than their actual skill. Table 7.3 highlights the key differences between observed and claimed eHealth literacy.

Table 7.3: Difference between claimed and observed eHealth literacy

Skill Perspective	**eHEALS score**		**Observation**
	Mean	*Median*	
I know how to find helpful health resources on the internet.	3	4	Everyone needed help. More than 50% couldn't complete the task even with help. Familiar with the idea of browsing but choosing and typing key words was challenging.
I know how to use the internet to answer my health questions.	3	4	No one had ever done it before, and everyone needed help. More than 50% couldn't complete the task even with help. Almost everyone had difficulty in choosing from search list Self-perception of health and comfort influences using electronic health information.
I know what health resources are available on the internet.	3	4	Everyone needed help. More than 50% could not complete the task even with help. No one knew about government site on HIV or their Facebook page.
I know where to find helpful health resources on the internet.	3	4	
I know how to use the health information I find on the internet to help me.	3	4	Everyone needed help. More than 50% could not complete the task even with help No one had ever done it before Self-perception of health and comfort influences using electronic health information
I have the skills I need to evaluate the health resources I find on the internet.	3	4	No one had ever done it before, and everyone needed help. More than 50% could not complete the task even with help. Almost everyone had difficulty in choosing from search list Not aware that google advertised sites are first to show in the search list.
I can tell high quality from low quality health resources on the internet.	3	3	

			Never really thought about the quality of electronic health information.
I feel confident in using information from the internet to make health decisions.	3	4	Everyone needed help. More than 50% could not complete the task even with help No one had ever done it before. Self-perception of health and comfort influences using electronic health information.

7.3 Context of Claimed and Observed eHealth Literacy: What Happens When College Students Make an Attempt to Access Electronic Information and Services?

eHealth literacy is a complex interplay of several personal and structural factors. And this become evident when some is trying to access electronic health information and services. During observation, it appeared that people's comfort level with handling electronic devices (technical skill), and their comfort with and acceptance of eHealth as a potential means for accessing healthcare and information depends on a number of factors. In this section I will discuss this by presenting cases depicting different scenarios.

Case Study 1: Experience of Momena (pseudonym); Age 22 Years

Momena is a newcomer to Mirzapur. She moved from a neighbouring district with her parents and two older brothers two years ago. Her father is a schoolteacher, her mother is a housewife and her brothers have their own small business in the town. Momena started as a student of Bachelor of Business Administration (BBA) in Mirzapur Degree College, last year. Noorie (my research assistant) and I interviewed her at her house on a Friday, the first day of the weekend in Bangladesh.

Momena comes from a typical Bangladeshi middle-class family, living in a typical semi-urban house. It is brick-built, and the walls do not have plaster on the outside. The inside of the house is plastered and was painted long ago with marks of wear and tear here and there. We sat in their living room which had a set of old sofas and a single bed. Maybe it is a bedroom at night for one of her brothers, a common way of living in Bangladesh. It was a hot afternoon with obvious power failure. There was one hand fan made of tapestry which both Noori and I shared. It was just the time for a glass of water, and Momena entered the room with two glasses of orange drink. The condensation around the glass was very pleasant to see. I thanked Momena for her trouble and finished the cold drink. It was just about the time to begin the interview. It was a good thing I spoke with her father before and got the permission for the interview.

Momena was just like some of participants I had already interviewed. She did not disagree with any of the eHEALS statements, i.e. I know I can find health information on the internet; I know how to use internet to find health information, I can evaluate health information that I find on the internet, I can use the information to make health decisions etc. Her responses to the eHEALS statements were mostly were either 'agree' or 'neutral' (neither agree nor disagree). However, both Noorie and I could see that she was struggling with the phone and the laptop. She struggled with browsing, typing, text messaging and speaking to a call centre person.

We began the tasks with the phone, Momena was asked to identify ways in which HIV/AIDS could be spread. And she got stuck right after she picked up the device. Our phone had a lock screen without any code or PIN. Just a simple upward swipe on the screen takes one to the home screen. But to wake up the phone,

one must press the power button. This is not unique to our phone, rather a regular feature of any android or similar mobile phone. Momena found the small power button on the side but was stuck on the lock screen. Instead of swiping, she started tapping the screen here and there and finally got to the home screen with Noorie's help. It was just the beginning of her struggle; she continued to fumble through the task. On the home screen, she could not identify the browser app. But after I pointed out the app, she could identify the search box. But she was unsure what to type and how to type. Again, with Noorie and my help, she could finally type in the search words in the box 'ways to spread HIV/AIDS' with obvious help with the autocorrect option. On the search list, she picked up that the first result was a link to the Centre for Disease Control (CDC) page with a whole lot of information in English. She got puzzled, so, I stepped in again. I asked her to go back to the previous page, but she couldn't, so I did it for her. In the list there was a link to the national HIV/AIDS programme of the Ministry of health of Bangladesh. I asked her if she could click that and see what was inside. The page had some information regarding sexual health and HIV and AIDS. She was too shy to go through the page. It is not uncommon among young college students of Bangladesh to be uncomfortable about having a discussion regarding one's sexual and reproductive health. On top of that, both Noorie and I were strangers.

Momena struggled a bit less with the same task on the laptop. She seemed better at handling a computer than a smartphone. She took the lid of the laptop up and pressed the power key above the keyboard without any hesitation. After the laptop came to life, she started looking for the browser icon in the desktop and found it eventually. Very carefully she then picked up the mouse and placed the cursor on the icon and double clicked the left button on the mouse. The browser opened with the google doodle and the search box under it. Then without prompting she typed in the search box. However, she had to look for the keys on the keyboard. She didn't need any prompts probably because she already knew what to type and also the laptop keyboard does not have autocorrect. This time I didn't insist her on digging too much in fear of making her more uncomfortable and losing the rapport.

Our next task was to read and send SMS messages. Momena could read the message on the phone with usual difficulties of reading in English and could send the same text to her own phone. But the call centre task was completely new to her. Firstly, she had never tried any call centre let alone a health call centre. Although she was aware of a call centre run by GrameenPhone (789), she couldn't remember the number correctly. She was stuck and although she had the internet open, she didn't try to search for the call centre number. After we told her it was 789, she smiled. 'Yes, I remember seeing those posters at the top up shops.' She called the number, waited for the agent to answer and then got so uncomfortable with the HIV and blood transfusion related questions that she couldn't finish the call. I asked her: 'what happened?' She got shy, smiled and said: 'we prefer to ask a doctor regarding any health issue if you need to, rather to ask someone whom you do not know or have never seen.'

The Facebook task ended very quickly, too. Momena does not have a Facebook account and had no idea about how social networking works. This was interesting to me. Only a few of my respondents so far had said that they do not know how social networking works. Momena was not completely unaware of social networks. She had heard of Facebook and saw some of her friends using it. She knew that on Facebook one can see photos of friends or a famous film star, maybe. One can also get information on many issues. A few weeks ago, one of her friends suggested to her that sleeping early is a great beauty tip which she got from the Facebook page of a popular Bangladeshi beautician. So, I asked her, 'Do you sleep early? Do you think you can trust information from Facebook?' Momena paused for a minute and said; 'I sleep early because my friend told me so. I believe her. You can get information from Facebook. That doesn't mean you can trust those. I have heard that even unknown people can be your friends on Facebook. I do not trust people whom I do not know. How can I trust information from them? Also, if I want to know about health or HIV how can I write that on Facebook? Won't everyone see that?'

Both Noorie and I had seen this before. After finishing the first and second parts of the interview, I was wondering why Momena was better at using a computer rather than a smartphone and why she wasn't familiar with social networking. Before we moved to the final (third) part of the interview, I asked about her smartphone ownership. They had four mobile phones in the house, one of which was a smartphone and belonged to her eldest brother. While all the men in the household had their own phones, Momena and her mother shared one.

Noorie asked, 'Momena, how come you have such good computer skills?' 'Oh, it's easy. I had a computer course as part of my school and college curriculum and we could use school and college computer in the lab. But there were not enough computers for everyone. So, we had to share one in groups,' Momena replied. I followed up on that 'What did you learn in those courses?' She said: 'We learned about operating systems, names of different computers parts with their functions, word processing and other Microsoft office software and internet browsing.' I asked her again: 'what did you learn about internet?' She replied hesitantly: 'I forgot. I did not want to embarrass her further and ended that part of the interview.

Momena was one of the typical participants in my interviews. She has her own phone to talk to her family and friends. She has heard about many things one can do by using the internet and technology. She also thinks that she has reasonable skill. Her eHEALS Score was 32. But, whilst performing eHEALS related tasks, she lacked all types of basic skills in using a phone or computers to seek information and services. Hypothetically, if she had those skills, would she have access to eHealth? The answer is, no. Momena tells us that it is about more than just the technical ability to operate a phone or laptop. Momena's belief regarding health is influenced by her own perception of health. Like many, she also finds health information/tips from her own sphere (in this case her friend) to be more reliable than from someone or somewhere unknown. She also prefers not to share health-related queries or views on public platforms or discuss them with anyone unknown.

Case Study 2: Experience of Shamim (pseudonym); Age 19 Years

I was waiting for Shamim at the Mirzapur bus stand. It takes about five minutes to walk there from where I live. The walk is entirely unpleasant as it gets so dusty that one can see that dust gets in the hair, and on the skin and clothes. My plan was to finish another interview at Mirzapur College, have my lunch and get to the bus station at around 3.30. So, I asked Shamim to meet me at Sattar's (pseudonym) tea stall at four in the afternoon. I thought, it will be nice to have tea with Shamim, and then both of us can go to Kumudini (where I stayed). It is very pleasant to sit by the large pond inside the Kumudini campus when the sun is kinder in the afternoon.

Shamim and I sat in the shade of an old lychee tree. He had already heard about my interviews, so was already on board. After explaining the ethical obligations, I explained the tasks to him. Shamim was very eager to participate. As I was about to start, he stopped me; 'Brother can I tell you something? I use "ishmartphoone" (smartphone) for last three years. My phone has a built-in television and four SIM card slots.' Now that was exciting to me. I have seen that owning smartphones is of special importance to the youngsters. These days it is a symbol of status and tech-superiority, both of which qualifies a person to be trendy and smart! I was excited to have a 'smart' participant for the interview. Also, I was curious to understand what smartphone television (TV) might look like. I have seen phones with quad SIM card slots, but not a TV! I asked Shamim if I could see his phone. Yes, it was a phone with a physical telescopic antenna. He then switched on the TV by touching a TV-like icon on the home screen. The app linked the phone to BTV (Bangladesh TV). It works like a small TV with an FM antenna. Although the picture quality was

terrible, we could see a popular advertisement of an anti-dandruff shampoo. I have heard of these Chinese phones and their multi-functionality but had never seen one before. Being truly blown away, I asked him more about the phone and whether it was an android phone or what. Shamim nodded his head affirmatively. It was android phone, but he did not know the version. I took a closer look at the phone; it was very similar to how an android phone looks with four network icons in the notification panel. But the built-in telescopic antenna was interesting. It looked similar to what transistors have. Shamim said; 'it's for getting better signals for TV or radio.' I asked him; 'where did you get it from?' 'Oh! I bought it from 'Mintu Telephone Services' (pseudonym) in the bus stand market. It's not that expensive, took me 6,000 takas (about £56),' he replied.

I went back to explaining the first part of the interview. I read the questions to him and asked him to answer each by checking the boxes. Shamim was very confident in responding either 'agree' or 'strongly agree' for all the questions. I thought, he must be an expert user when it comes to technology. But the task part of the interview showed the opposite. Shamim did not have enough skill to browse the internet on phone and was completely unable to do it using a laptop. He was unfamiliar with the laptop keyboard and I had to let the computer part of the task go. He was confused which app to tap for browsing on the interview phone internet and needed my help. Typing in Bangla using English letters was challenging for him and that was not only because of the autocorrect. His SMS skill was very basic; he could successfully forward a SMS to one of his friends on the fourth attempt and I helped him to find the option 'forward' from the SMS menu. He even struggled with finding the 'three dots' on the top left corner where options are located. I also helped him in composing the SMS. However, he was comfortable with making the phone call, but I told him the call centre number. He did not know the number but had heard of health call centres run by various mobile companies in the country. He was also very uncomfortable about asking HIV related queries to a call centre doctor.

Being curious, I asked Shamim to take his phone out again and asked him to use the internet on it. His struggle continued even with his own phone, but his interaction was better. His typing was also better. His phone's keyboard could type directly in Bangla with English keys, like the phonetic keyboards do. And Shamim was better with the layout of the keyboard on his own phone. However, he continued to struggle with constructing words and needed help to navigate the phone to choose the right app. He also needed help with the SMS. For ethical reasons, I could not ask him to continue using his phone for the tasks, but it was clear to me he probably lacked basic skills to use the internet or SMS using mobile phones or laptops. Shamim's technical ability was like what was demonstrated by many of my participants who have their own smartphones but also struggle with the basic skills to fully use their phones. Often, they are dependent on friends who have a better understanding of technology. It was fascinating to me why someone with personal access to smartphone would lack in basic skills to use the internet or SMS? I moved to the next segment of my interview.

Figure 7.2 shows us that a considerable number of people could not complete the tasks, and those who could also needed help. Shamim was one of them. His eHEALS Score was 26. Like many of his peers I interviewed, he lacked the basic skills to use a phone or computer for browsing the internet yet, thought he had enough skill to do so. In the field of digital skill, often people overestimate their skill (ECDL Foundation, 2016). Also among students, males often overestimate their skill more than females (Hargittai & Shafer, 2006; Kaarakainen et al., 2017). A recently published systematic review of 53 studies shows that self-assessment of digital familiarity and information literacy is often incorrect and people with low skill tend to overestimate their skill status (Gross & Latham, 2012; Mahmood, 2016). The case

of Shamim tells us that access to eHealth is influenced by experiences of using both technology and information, which he lacked. However, for all college students this was not the case, which brings us to the next case.

Case Study 3: Experience of Alomoti (pseudonym); Age 21 Years

I was waiting at one of the tea stalls opposite to Mirzapur District College entrance with my female research assistant (Noorie) for Alomoti. She was a female student in her first year of a Bachelor of Commerce programme. I had interviewed one of her classmates a few days earlier and at the end of the interview, Alomoti's friend suggested her name and gave me her mobile number. I was hesitant, as it may not been culturally appropriate to call her. So Noorie made contact and fixed the appointment.

Mirzapur Degree College is one of the largest in the Tangail district. It is within walking distance of the Upazila Parishad (Sub-District headquarter). Hence it is accessible by any means of transportation. At this time of the day, often there is a small crowd of five to six people in the tea stall, mostly men, chatting and drinking tea. Our plan was to move to the college yard and find a corner for the interview (Noorie had secured permission from the college office in advance).

It was almost 2.40pm and we were patiently waiting under the shade of the tea stall. I was about to order a second round of tea when groups of students started coming out through the gate. Noorie and I thought, it is almost time, Alomoti should be here any minute. After about 10 minutes a girl, her head covered by a head scarf, waved at us from amongst a small group of students. Both Noorie and I were happy and surprised at the same time. We had, several times in the past couple of months, set up appointments, only to find that the sessions didn't happen. It was also partly because it is not very common for a college girl in a semi-urban sub-district of Bangladesh to casually wave at visitors. After exchanging greetings and pleasantries, the three of us moved to the college yard. Alomoti preferred to be outside, so we sat on the cemented base of a large tree in one corner of the yard, beside the college Shahid Minar (the memorial built for the martyrs of the Bangla Language Movement in 1952).

Noorie started the conversation: 'Alomoti, do you want to call anyone at home? This may take about an hour or two. Aren't they [family members of Alomoti] expecting you to be home after the class finishes?' 'It is fine,' Alomoti replied confidently, 'they know already. Besides you and bhaia [brother, addressed towards me] have talked to two of my friends who live in our neighbourhood.' I then started by explaining the ethical obligations and steps of the discussion; 'do you agree to participate?' She smiled and nodded. 'I know, my friend already told me.' Suddenly the discussion seemed easier.

In this research, and as indicated in Chapters Four and Five, young and educated people appear to be savvier compared to the rest of the population regarding the use of mobile phones or the internet. They are often very prompt in responding affirmatively to questions like: can you use electronic devices (cell phones) or do you know how to use internet? etc. Alomoti was no different, she was very quick to respond: 'agree' and 'strongly agree' to questions asking about her knowledge of how and where to find helpful health-related information on the internet, using the internet to answer her health-related queries, types of available online health-related information, use of the health information found on the internet, skills to judge the trustworthiness of the online health-related information and making decisions based on the health information found electronically. Alomoti responded to all the eight eHEALS questions almost without any hesitation, within about five minutes. She would have taken less time if we had not also explained the skill parts of the questions with examples. The next part of the interview was more challenging. Noorie explained that the tasks were to find and share relevant HIV-related information using the internet and mobile network (voice and text). And to do that, Alomoti would have to use a laptop and smartphone.

Handling a smartphone was not much of a problem for her. She took the smartphone from me and smiled. 'I have an android phone, too. Mine is Symphony (a popular Chinese brand).' I showed my interest. 'Oh! It looks so new.' She chuckled; 'my older brother bought it for me couple of months ago. I use it with a case and screen protector. Cannot risk damaging it or he might get angry.' Alomoti did almost all the hardware-related tasks easily except a few. She got confused finding the browser on the laptop, but on the smartphone, it was not a problem. In both cases, she could power up the devices easily. While she struggled in finding the right keys on the laptop, again on the smartphone, she was fine. Clicking with a mouse or touch typing or touching the right place on the smartphone screen was also easy for Alomoti. I was convinced that she would find the tasks easy and that she was familiar with the basic idea of browsing the internet using a laptop or smartphone.

However, performing some of the tasks was not entirely smooth. Alomoti needed help with what to write in the search box. Her discomfort was showing in her frowned eyebrows and hesitant fingers. I then helped her by reading the tasks from the guideline again. But typing direct English sentences was challenging for her. Both Noorie and I noticed a tinge of shyness and discomfort on her face as she struggled with the English. This was not uncommon in Bangladesh as the primary medium of study is Bangla (Bengali). Noorie suggested that Alomoti can type Bangla words using the English keyboard. We had used this technique in almost all of our previous interviews as well. Sending Bangla text messages while using the English alphabet is very popular in Bangladesh and Mirzapur was no exception. However, this turned out to be another test of skill for the participants which I had not realised before. Android keyboards have a built-in auto correct feature. Once a word is mistyped, the device automatically corrects the spelling. When someone is trying words in Bangla using English letters, this happened with every word. This can be turned off in the keyboard settings or during typing. The keyboard usually corrects the spelling after pressing the space bar. But if the backspace is pressed immediately after autocorrection, the word changes to its typed form, i.e. the Bangla word in English letters. I left the autocorrect option 'on' in the setting. While many interviewees struggled with the autocorrect, Alomoti was one of the few who could fix the words by hitting the backspace after each autocorrection. Later we came to know that Alomoti's elder sister lives in a Middle Eastern country with her husband. The two sisters often chat about their daily life through texts. This must have made her familiar with the autocorrect situation during typing.

Alomoti was also comfortable with Facebook and SMS tasks. To access Facebook, she preferred using her own mobile number. However, she was aware that Facebook can be accessed through a personal email as well. But like many young Bangladeshi who live in peri-urban and rural areas, Alomoti did not have an email account. Finding groups and pages in Facebook, looking at friends' profiles and comments, browsing through notifications, sharing photos and making comments were things that she did on Facebook once or twice a week. Calling a health call centre was also not a problem. But she was uncomfortable asking a call centre agent about HIV. 'How did I do?' Alomoti asked us right after finishing the last task of calling the call centre. Both Noorie and I smiled and assured her that it was great, which we did for all our respondents. I looked at my timer, she took about 35 minutes to finish all the tasks.

Alomoti was very good with electronic devices and platforms. Her eHEALS score was 32. She demonstrated: considerable skill to boot up a laptop or phone, familiarity with techniques of browsing the internet, interacting with social media, using SMS as an option for communication and the hardware challenges like autocorrects and typing Bangla words using English letters. Yet her access to electronic platforms was compromised due to a lack of understanding or knowledge of the search technique to seek electronic health information and services. She was also uncomfortable discussing a health issue like HIV

which relates to very intimate sexual and reproductive health need. Furthermore, her skills are related to her daily use of technology, i.e. chatting with her sister. Seeking electronic health information or services was not something she was very familiar with. This indicates that while discussion regarding access to technology often focuses on ownership of devices or technical skill, it is also important to understand that even for owners with considerable technical skill, access to eHealth can be restricted because of one's perceptions and preferences about health and wellbeing, and because of how one interacts with different forms of electronic platforms. Evidence from a groups of students from New Jersey regarding their web use suggests that male and female students have different purposes for using technology based on their perception and need (Hargittai & Shafer, 2006). Alomoti's case was one of the rare ones among the participants I interviewed in that she demonstrated a high level of technical skill.

Globally, networking through social media is a very popular form communication. Considering the depth and breadth of its popularity, many consider it to be an ideal platform for knowledge sharing. A recently published meta-analysis and systematic review of the use of social media among medical students concluded that it is very popular and can be used to train medical professionals in order to build their information literacy (Guraya, 2016). Considering its importance, it was later incorporated in the eHealth literacy model as eHealth literacy 2.0. I did not find many college students during my interviews in Mirzapur who were very proficient in using social media. But those who were had higher skills and a better understanding of the use of technology.

Case Study 4: Experience of Rafique (pseudonym); Age 22 Years

The Computer Officer of Mirzapur Degree College is probably the best person to talk to if you are eager to meet young people and students of the college. He is a lovely person, father of two three-year old twin daughters and he has spent his entire life in Mirzapur. While some call him Sir, he is more popularly known as Malek Bhai (brother Malek, pseudonym). The field research officer of the icddr,b Mirzapur office introduced me to Malek Bhai. After chatting about my purpose over tea, Malek Bhai introduced me to 20-year-old Rafique who was a first-year student of sociology at the College.

Rafique lives at the heart of Mirzapur with his parents, who have lived in the town for generations. His elder sister recently moved to Bahrain with her newlywed husband. Rafique is a smart young man, fashionably dressed and sporting a branded smartphone (Samsung). To get warmed up and to probe his knowledge, I showed my interest in his phone: 'wow, it's a nice one Rafique!' 'Ah, yeah! Just bought that last year. It is an android Lollipop phone!' he replied. I was surprised to hear someone referring to terms like 'Android' and 'Lollipop'. What he meant was that the phone was an Android version 5 phone, based on an operating system

that launched in 2014. At that point, I had interviewed about 15 people, but none could talk about the operating system of their own smartphone. Even for someone in a developed country, I thought to myself, the most commonly known aspects of a smartphone are probably the brand, apps and how good the display is.

Explaining the interview parts was easy. We started with the skill and knowledge of the interviewee. Rafique quickly responded with 'agree' and 'strongly agree' to all the eight questions, mostly without hesitation. I did not have to explain the questions with real life scenarios. He could easily pick up on each and responded spontaneously. Then he performed the tasks using the phone and laptop: browsing the internet, sending out SMS, using social media and making phone calls to the call centre. As I expected, he could complete almost all without major difficulty; including which app to use for browsing, where to type words, handling typos while typing, and getting comfortable with the small keyboard etc.

He quickly picked up the interview phone, browsed about the phone for a minute or two and chose 'Google Chrome' to browse the ways to spread HIV. He went through the first page of the search results, picked up one of the links and started reading it. On the laptop, he was a bit slower, though. During the entire time I didn't help or prompt except for helping him with English or with deciding what to type or say for making the health-related query. He was also very comfortable with SMS, social networking or calling a call centre doctor. He knew the number '789' which is the number for a health call centre run by GrameenPhone and could ask about donating blood and its relationship with contracting HIV. I asked him, 'how come are you so comfortable when talking to a call centre?' 'Oh! I have talked to call centre to activate and troubleshoot my internet packages several times in the past. Nowadays, you can do it by SMS,' he replied.

Although I still had another part of the interview to get through, I couldn't help ask Rafique: 'it seems like you are very good with technology and the internet. How did you learn all this?' He replied: 'I enjoy using internet. You can learn a lot in a short period of time. It is much better than reading books. Also, I have a Facebook page called "we are people of Mirzapur". I update the page everyday with various events and news about Mirzapur. My page has more than 500 followers. When you are very active on social media, you automatically become very good in using technology and internet.' This was a very interesting experience for me. It seemed like Rafique belongs to the global tech-savvy generation. As he explained, it seems like being active and regular on social media can contribute to acquiring detailed knowledge of using technology and the internet.

Rafique's eHEALS score was 32. His experience shows how having experience of interacting with information can foster better skills. He was one of the very few who could use a laptop effectively to seek information. Both Alomoti and Rafique's familiarity with devices (phone and computer) and information has made them better equipped to access eHealth and mHealth, perhaps outliers among their peers. However, they may not be fully equipped. I noticed that both were unsure and hesitant regarding their search words. It is obvious that 'English' can be a barrier for using technology for seeking healthcare and information, but it is also important to understand that seeking eHealth and mHealth services electronically is not a regular practice in Bangladesh. They may be in a better position; however, whether they can make health-related decisions based on their access to eHealth and mHealth is a

different issue. In that sense, the perceived quality of the services, underlying healthcare-seeking practices and related beliefs may lead to restricted access. This was explored in the third part of my interview.

Case Study 5: Story of Shishir (pseudonym); Age 21 Years

Before I started interviewing Shishir, we chatted for about 20 minutes. Shishir and I both come from Rajbari, a district in southern Bangladesh. Although I was born and brought up in Dhaka, I used to visit my ancestral home during school breaks and other festivals like Eid. Shishir had played football in the large playground beside my grandfather's house. I was curious to know if the college students of Rajbari are like those of Mirzapur regarding using phones and computers. 'Oh yes! of course. It is the same everywhere. I think you will get everything in Rajbari that is available here. But sometimes things are available there a little later than in Mirzapur,' Shishir informed me.

Shishir's father moved to Mirzapur about 10 years ago, Shishir was in high school then. He and his mother moved here three years ago, right after his Higher-Secondary School Certificate (HSC) exam. After the exam Shishir took admission in Mirzapur Degree College to study a B.Sc. in chemistry. He got his first phone quite early compared to his friends. His mother had a phone for talking to his father, which he was in charge of, which was an ordinary Nokia phone. Two years ago, they acquired their first smartphone (Symphony). Shishir got the phone as a gift after he got admitted in the Bachelor course, and he maintained it himself. He tutored two high school students separately, which was enough to pay his phone bills. He was also one of the few participants I interviewed who had his own computer.

My interview with Shishir was completed in record time. He responded, 'strongly agree' or 'agree' to the eight eHEALS statements with confidence. He also completed all tasks boldly and mostly in one to two tries. I sensed on a scale of 10, he probably scored a straight 10. He was familiar with using the internet on a phone or computer. His own phone (Symphony) was an android phone. So, he had no problem in demonstrating the use of internet on our phone. He picked up the phone with confidence and start using the browser app on the home screen. He had already heard of the task in Bangla. So, he translated the task in English, 'how HIV spread' and typed confidently in the search box. Shishir knew that if we enter key words in the address box, a list of relevant pages will come up. However, he did not know which ones were reliable and authentic. Usually he picked up one from the top three from the list. In this case, the first two in the list were links to HIV.gov and CDC (Centre for Disease Control) pages and both of those modified the word 'spread' to 'transmission'; so 'how is HIV transmitted?' The third one was from HIV.gov but the title was; 'How is HIV spread?' So, he chose that and entered the page. It was an US government page and was written in English. He asked; 'shall I read it?' I asked him to give it a try and he started reading it. It was a fairly technical description of how HIV is transmitted through sexual acts, blood transfusion and placenta (mother to child). After about a minute, Shishir got impatient and wanted to move on to the next task. So, I asked, 'did you learn anything?' He immediately replied, 'oh yes! I know all these already. There are programmes and advertisements on the TV explaining these things. But it is in Bangla. One problem with the internet is everything is in English. It is not easy to read everything in English when you are a Bangladeshi.' This was not unique about Shishir, most of my respondents found that using the internet is hard because most of the content is in English. We moved on to the laptop part.

Shishir was one of the few participants, who had a desktop computer at home. He was good with the laptop, too. Performing the same search on a laptop was straight forward for him. He powered up the laptop and found the browser icon easily. On top of it, his handling of the keyboard showed that he was used to using one. The same search results came, and I concluded that yes, he is good with a laptop, too! I couldn't help but ask him; 'how come you are so good with the keyboard?' 'I play lot of games on my desktop. Almost every day. Also, I use Facebook and YouTube, both on my desktop and phone,' he replied.

The SMS and call centre tasks were very straightforward for Shishir. He had no problem typing up the dummy message and sending it to his own phone from the interview phone. He could also very easily create a

group text and send it to his three friends. He was also confident in making a call to a Healthline. He chose the 789 Grameenphone call centre and talked to the call centre agent without any apparent hesitation. I was very impressed. Many of my respondents were familiar with SMS but not many could do group SMS messaging. Also talking to a call centre agent was not easy for everyone. Shishir was confident throughout the SMS and call centre tasks. So, I asked him what the reason was. Shishir smiled and said: 'Bangladesh is becoming more and more technology based every day. I got my HSC exam result through SMS. Every day we get SMS regarding new and attractive mobile phone packages or immunisation service from the government. Also, sending SMS sometimes can be very effective communication if your friend is unavailable. If you have a mobile phone, then call centre is a regular part of your life. Every now and then I talk to the call centre agent of my mobile phone (operator) to activate the internet or to understand my mobile account. But these days we can do it by SMS, too.' However, he sometimes finds it difficult to believe the call centre agent. He cited an example regarding being charged for dropped calls. It happened several times with him when his call was dropped but still, he was charged. And talking to the operator's call centre agent had never worked. At this point I asked him: 'Would you believe health information from a health call centre agent?' He reluctantly said: 'No, I do not think I will rely on their information. Without seeing the patient or not being aware of my neighbourhood or my town, how can someone trust their solutions? Health is very important, and disease need to be treated carefully. I think I will better go to our Kumudini hospital.'

In case of social networking, he usually liked to access groups and pages liked and shared by his friends. In the task, when he browsed about ways to spread HIV, he was surprised to know that touching or sharing food do not spread HIV. During discussion, his stand remained the same. He preferred not to touch any person with HIV. He explained that his interpretation of information was influenced by social beliefs and practices.

Shishir was a very technically capable young man. He was aware of the versatile use of the internet, mobile phones and computers. He was also a user of various online and phone-based services. Based on my experience, not every college student was capable as Shishir. However, his interpretation of health information through electronic platforms was that it is 'not so trustworthy.' He thought that traditional healthcare and information-seeking via a medical doctor or hospital is more effective and trustworthy than an online platform. Also, his sense of trustworthiness seemed to be influenced by his own knowledge and opinion of the issue.

Shishir is another example of a participant who had good knowledge and skill in using phones and computers, what we often refer to as *technical skill*. His eHEALS score, unlike others of his type, was low (21). Perhaps this was because he was not confident of looking up health-related information and scored himself low on the scale. Nonetheless, interviews like the ones with Alomoti, Rafique and Shishir took less time. They were confident and sure about what they were doing. Their knowledge and use of information through different electronic platforms were good. They also have considerable skill in using electronic devices. Yet, their access to eHealth and mHealth based services and information was limited. For them, it was primarily because of a general discomfort with discussing health with someone unknown and the associated trust (or lack of trust) in electronic healthcare and information. This coincides with the understanding of people's care-seeking behaviour as largely influenced by an individual's personal

social construction around health and care-seeking, known as the explanatory model of illness (Helman, 1985; Williams & Healy, 2001).

Observation of tasks performed by the participants shows that young people must have certain abilities to be able to access eHealth and mHealth. These include technological skill to navigate electronic devices, ability to use various electronic platforms, perception regarding the usefulness of the electronic information in ones' life and perception about health and illness. To explore these aspects, the participants were interviewed using the dimensions of eHealth literacy. In the next section, I will discuss how participants' understanding of health, information and technology can influence access to eHealth and mHealth.

7.4 eHealth Literacy and Access To eHealth and mHealth: Perspectives of the College Students of Mirzapur

The eHealth literacy model explains that people's eHealth literacy is a complex interaction between users' technical skill for navigating devices and their ability to interact with information (C. Norman, 2011). Based on the eHEALS exercise, this ability appeared to be closely linked to participants' perceptions. In this section, I will explore participants' perceptions, using the attributing factors described in the eHealth Literacy models as critical to users' ability to interact with information. These include: a. basic language skills such as reading, understanding, speaking and writing texts (traditional literacy), b. the ability to think critically about the content presented by the media, i.e. weigh- up the media-delivered information by placing it in a socio-political context (media literacy) and c. the ability to organise knowledge, alongside the process of finding and using information and sharing the experience with others (information literacy). This includes the ability to assess the quality of the information (authenticity) and access various media platforms such as social media, websites etc. (Norman, 2011; Tennant et al., 2015; Yang, Luo, & Chiang, 2017). Based on this, participants were asked to share their knowledge about sexual and reproductive health (SRH), interactions with health information, perspectives on access to technologies, perspectives on the use of technology for seeking information, perspectives on social

networking and perspectives on the quality of health information on the internet and social media platforms.

7.4.1 Knowledge About Sexual and Reproductive Health (SRH)

Sexual and reproductive health programmes targeting younger age groups are being implemented by the Government of Bangladesh (GoB) and by NGOs. A recent report documented 32 public health initiatives that have SRH components, about 16 of which were targeted at adolescents (10 to 19 years old) (Ainul, Bajracharya, Reichenbach, & Gilles, 2017). Also, in the national electronic media, SRH awareness-building and other informative programs are forecasted regularly. Thus, the tasks were designed in relation to sexual and reproductive health. During the interviews, participants were asked about various bodily functions and changes related to the reproductive system, associated diseases and associated prevention. Half (30; 11 males and 19 females) of the respondents could describe various physical, mental and behaviour changes related to *Boyoshondhi* (puberty). They mentioned changes related to voice, and physical changes to their bodies. None were comfortable discussing the changes related to reproductive organs. They also talked about how both males and females become increasingly shy, relatively calm and quiet during and after puberty. It was not easy to discuss the functions of the reproductive organs because of their reluctance and shyness, but they appeared to have some idea about heterosexual relationship (dating), copulation, *ritusrab* (menstruation) and *shopnodosh* (nocturnal emission). None mentioned hormonal changes. For boys, hormones were synonymous with semen. Also, no one could mention the age range for puberty correctly. The most common response regarding pubertal age was 13 to 18 for males and 12-14 or 13-19 for females.

Seven respondents (four male and three female) knew about puberty but could not describe/explain the physical, mental and behaviour changes in detail. One male college student attending one of the first-year bachelor programmes, said: *'Boyoshondhi bolte ami bhuji eta ekta nirdishto samoy. Dhoren baro (12) bochor boyosh hoile sadharonoto sharirik poriborton dekha dey. Jemon dhoren cheleder dari ute, shopnodosh hoy, meyeder buk fule uthe, ei sob ar ki. Erokom choddo (14) bochor boyosh projonto cholte thake.'* ('As I understand, puberty is a specific time. This starts at the age of 12 which means growing a beard and nocturnal

emissions for the boys and breasts start growing for the girls.') Another female college student in the first year of a Bachelor programme mentioned: *'… amar mote boyoshondhi kal holo emon ekta shomoy jokhon meyeder sharirik, manoshik ebong acher achoron e poriborton dhekha dey. Bishes kore jokhon meyeder mashik shuru hoi tokhon mone hoy je boyoshondhi kal hoyeche.'* ('I think puberty is a time for the girls when they start experiencing physical, mental and behavioural changes. When girls start menstruating, it is called puberty.')

Twenty-three respondents (20 male and three female) claimed that they had no idea about puberty and related changes. This was very surprising. But after discussing *Boyoshondhi* (puberty) with them, it seemed that male students tended to consider pubertal changes as synonymous with sexual acts. That was why they were very reluctant (shy) to discuss it with a stranger. Even after repeated probing and help they remained hesitant and at the end resistant to the discussion. As one male participant in second year of college said: *'… ami jani boyoshondhi kal bolte ki bujhay. Ashole eita chele ebong meyeder gopon kotha. Ami eta bolte parbo na. Onno kichu bolen bhai.'* ('I know what puberty means. It is a very private and intimate experience for boys and girls. Please do not ask me about these, I won't be able to say anything.') Another female student who had recently passed her H.S.C. exam said: *'… amare maf koren apa, ami boyoshondhi niye kotha bolte parbo na. Eita bhishon lojjar bishoy. Onno kichu bolen.'* ('Please forgive me, I cannot say anything about puberty, I am too shy. It is a very shameful experience. Let's talk about something else.')

Considering that the discussion regarding the physical changes was uncomfortable for the participants, I tried to explore their understanding of male and female mental and behavioural change during puberty. But most of the participants had no specific idea about puberty-related mental and behavioural changes. Their understanding of puberty was mostly limited to physical changes. I mentioned two common Bangla words repeatedly, *ritusrab* and *shopnodosh.* However, no girls could (or were unwilling to) explain what *shopnodosh* (nocturnal emission) was. Similarly, no boys could (or were unwilling to) explain what *ritusrab* (menstruation) was.

When asked about sexual and reproductive health care, 27 of the respondents (17 male and 10 female) had knowledge about regular family planning needs and methods; pills and condoms. To them it was merely an option for birth control. While only few could mention injectables and menstrual

regulation (MR), no one had knowledge about intra-uterine devices (IUDs). As a result, the discussion around techniques of use of different family planning methods was mostly vague and incomplete. One of the male participants said: *'poribar porikalpanar bivinno maddhom holo poribar choto rakhar upay'* ('family planning methods are for keeping the family small, only'). Another mentioned that: *'MR and injectable ki ami jani na. Ajkei ami apner kache prothom shunlam. Er age kokhono eta ami suninai'* ('I do not know what MR and injectables are. I just heard it from you, before today I have never heard of it'). I found this not surprising at all. In Bangladesh, sexuality is not a comfortable topic for discussion within the family or openly in a community. Unless someone is married, it is very hard to get a clear idea about family planning methods.

But almost all knew where to seek and how to access to *Jonmo Niontron* (birth control) services. As for the knowledge about *'jounorog'* (sexually transmitted diseases (STD)), while everyone had heard about HIV and AIDS, only 36 respondents (30 male and 6 female) had heard of syphilis and gonorrhoea. But no one could explain the transmissions, symptoms and signs of STDs exactly. To most of them, the signs and symptoms of STD were either *dhatu* (white discharge) or diminution of *songomer iccha o khomota* (libido and sexual performance). One female college student said: *'MR, STD eigula bisoy amra bhalo bhabe Janina. Eigula niye temon alochona hoise boleo mone more na. Majhe moddhe edik shedik poster dekhi, kintu mon dia temon bhalo bhabe pora hoy nai, loke bhabte pare amar oigula shomossa ache'* ('we do not know much about MR, STD etc. I do not remember much discussion about these. I have seen some posters mentioning those, but never read those carefully. Because people may think I have those problems'). Given this context, the general shyness about sexuality and family planning, it is not surprising that the young people do not know very much about sexual health and do not wish to appear curious about it, even if it is through eHealth.

Another factor which forms part of the context of Mirzapur and influences young people's use of eHealth is the availability of health services locally. We have discussed this in Chapter Five and also in the case studies above. Almost everyone mentioned that people of Mirzapur prefer to seek healthcare at the nearby *Kumudini* hospital or the Upazila (Sub-district) Health Complex. Sometimes they also go to

private providers such as clinics, chambers of formal doctors and NGO facilities for specific services. As one of the female participants mentioned: *'… amar pura poribar Kumudini haspatal-e jay. Ami-o choto theika jai. Oikhane nurse daktar-der chini, tarao amare chine. Shmossa oikhan e bhalo na hoile, majhe upazila haspal-e jai. Somossa aro boro hoile jai Dhaka. Eigula shubidha na thakle hoyto eishob jaygay (eHealth) phone kortam.'* ('My whole family and I go to Kumudini Hospital. We know the doctors and nurses in that hospital, they know us, too. If needed sometimes we go to the Upazila Health Complex. If the problem is more complicated, we go to Dhaka. If we did not have such opportunities, we probably would have considered calling the health call centres').

7.4.2 Interaction with Health Information

The eHealth literacy model states that in order to access electronic health information, people must have some understanding about written forms of information. This helps people interpret information for informed decision-making. An inquiry process includes people's ability to transform data into information and then transform information into decisions (Gummer & Mandinach, 2015). A systematic review published in 2015 explained that some studies have shown that people tend to go for screening colorectal cancer (CRC) more if they have more knowledge about CRC (van der Heide, Uiters, Jantine Schuit, Rademakers, & Fransen, 2015). Another systematic review of the association between the presence of information of healthcare performance and people's decision-making showed that decision-making becomes easy for people if the display of information is easily comprehensible (Kurtzman & Greene, 2016). Therefore, in order to understand access to electronic health information and services for college students, the participants were asked about their understanding of electronic information in written form, their interactions with video formats and their interpretations of numerical information.

To start the discussion about written information, the participants were asked about health-related articles on the internet. Everyone said that they had never read any health-related articles on the internet or in any other form. So, I asked, 'why have you never read any?' One of the female student participants mentioned: *'… proyojon hoi nai kokhono. Ar tachara ami to janio na eigula kothay ba kemne pawa jay. Tai eibhabe je kora jay tar dharona nai amar'* ('… never needed that. Besides, I do not know where or how to

get such information. That's why I have no idea that we can seek health-related information on the internet'). After repeated probing, some mentioned that they may have read a few lines from a newspaper article or on Facebook, especially if it was about a diet-related tip or lifestyle-related advice. The participants also added that it was always better if the article was in Bangla. One of the male participants said: *'… shastho bisoyok lekha pora hoy nai karon amra English-e durbol. Ei karone eta sadharonoto pora hoy na. Tachara kothay pabo eta bhalo bhabe jani-o na to'* ('I have never read a health-related write up on the internet because I am not good in English. Besides, I also do not know where to get such information').

To explore participants' interaction with video-based information, we discussed watching YouTube. Twenty-seven respondents (13 male and 14 female) confirmed that they watched YouTube videos sometimes. But none of those videos were about health. Among the female students, three mentioned that they had never heard of YouTube. About half of the respondents (33; 21 males and 12 females) preferred video content over written content because the people presenting in video were seen to be very smart, like movie or drama stars. And, the college students of Mirzapur argued, it was interesting when someone smart was speaking! And also, video-based information was similar to watching things happening in front of one's eyes. One of the male participants explained: *'… ami shadharonoto general page-er chaite YouTube ke beshi bishshas kori. Karon page-e keu kichu likhse, ar YouTube-e shorashori dhekha jay. Eita tai nijer chokhe dekhar moto. Tai ami YouTube-ke beshi bishshash kori'* ('I generally believe that YouTube is like watching with your own eyes, whereas a page has been written by someone. That's why I trust YouTube.') Nineteen respondents preferred written information over video because they thought it was more authentic. According to them, video can be presented in such a way that false information can appear to be true. They also thought that writing could not be deceptive. The remaining participants could not decide which format of information was more authentic or of better quality. One of them (a female college student) mentioned: *'… ami general page ebong YouTube duita-i agey dekhbo. Tarpor jeta amar kache valo mone hobe ami shei moto shiddhanto nebo. Ami to nijei bujhbo konta bhalo ar konta kharap. Bhalo kharap chinta korei bishshash korbo, tobe amar mote duitai bishshash kora jay'* ('I will watch both webpages and YouTube. If something is not true, I will understand and that will help me to decide. But generally, both,

webpages and YouTube can be trusted'). Discourse on trustworthiness about media format and content is not new. There are many reasons why some people find video more trustworthy than a website and vice versa. People sometimes find job recruitment announcements through social media, is more reliable because it is often attested by peers. Sometimes this makes someone taking the news found through social media more seriously with or without approval of their peers. The same goes for other internet-based forms as well (Frasca & Edwards, 2017; Flanagin & Metzger, 2014, pp. 419–421).

Using electronic health service provision may also involve interpreting technical and numerical data. In order to understand participants' ability to interpret technical numerical data, the respondents were shown a weather website (http://www.bbc.co.uk/weather) detailing the weather in Dhaka, Bangladesh at the time of interview. Figure 7.3 presents a screenshot of what it looked like. Altogether, 27 respondents could interpret the temperature. However, only six of the participants could also read the projections and understand the weather symbols.

Figure 7.3: Screen shot of website showing the weather of Dhaka (BBC.com/weather)

The main barrier felt by the participants when interacting with written, video and numerical forms of information was 'English'. In Bangladesh, the language of the traditional education system is Bangla. It is understandable that any information displayed in English is hard for the participants to interpret and

use for making decisions. However, if the contents were in Bangla, would this have made it easier for the participants interact with electronic health information? Although there was no way to investigate that, but my guess is probably it would have continued to be difficult for them. It was very clear that participants had some skill in understanding written, video and numerical content. During task performance, they had to read both letters and numbers. Also, many talked about videos on social media or YouTube (see discussion on Tasks). On the other hand, they had never explored health information online. The only form of health-related information they had ever tried, was either lifestyle (mostly about different exercise and beauty tips) and/or diet related. This indicates that their use of information has been influenced by their need. Kleine's choice framework shows how Chileans perceived ICT to be a beneficial tool for their overall wellbeing (Kleine, 2009; Kleine, 2013). Scoping studies on BKash (mobile wallet initiatives in Bangladesh) also showed the same (bKash, 2017; Quadir, 2015). Based on the findings here, there are two aspects to this:

a. What people perceive and what people do. This is like the difference between claimed and actual eHealth literacy. When asked, people have mentioned that they find eHealth to be beneficial for accessing healthcare. There is evidence that people consider eHealth and mHealth to be beneficial, i.e. the scoping study of Aponjon (the Bangladesh MAMA initiative). However, it is also evident that Aponjon was really popular in terms of its use (Alam et al., 2017; Rajan et al., 2013).
b. People may not perceive eHealth to be an effective means for accessing healthcare. Here, the young people do not seem to perceive eHealth to be a beneficial tool for accessing healthcare. But if they had perceived this as beneficial, would they have used it effectively? There is no straight answer to this.

We have talked about how the community care seeking is a social and personal experience and governed by the explanatory model of illness. It appeared that participants had limited ideas about how to assess the quality of the information. Without being able to assess the quality, it is next to impossible to use any service effectively. Thus, the college students' experience and interaction with electronic

information is suggestive of limited access to eHealth due to context, type of electronic mean, lack of purpose and inability to assess the quality.

7.4.3 Perspectives of Access to Technology

Chapter Five was about understanding access to healthcare through ownership of devices and mobile-cellular network (eHealth). Among the participants, 38 (22 male and 16 female) had smartphones and 24 (15 male and 9 female) had regular mobile phones. The smartphones had Android operating systems. Two male participants had both smartphones and regular mobile phones. About 15 participants admitted that they had more than one SIM card. However, discussion on multiple SIM cards was not comfortable for the participants. The probable reason for this discomfort was the ongoing campaign by the Government of Bangladesh asking for the registration of all SIM cards with legal documents and identifications. Nine participants (five male and four female) had laptops in their households. The laptops mostly belonged to their older siblings or other older family members. For most of the, laptop was accessible by the corresponding participants occasionally. One of the female participants said: *'… amar bhai gotobochor ekta laptop kinse. Shathe internet modem. She oita diye chobi dekhe, gan shune. Abar majhe kaj kore. Ami majhe boshte pari, kintu she na thakle boshi na. Bhai na thakle laptop dhorle she khub raag kore. To be beshi ghataghati o kori na, Jodi nosto hoye jay?'* ('My brother brought a laptop last year. He uses it to watch movies, listen to music and sometimes for work. I am only allowed to use the laptop if he is around. But I do not use it much. What if I mess it up?')

During discussions about access to computers, I considered both personal and household ownership. So, I asked everyone: 'so, you have no preference about using a computer?' Almost everyone mentioned the computer labs at their college. ICT is part of the secondary and higher-secondary school curriculum nowadays. Thus, any educational institute ideally has a computer lab with desktops no matter how old it may be. Most of my participants were students of Mirzapur Degree College. The computer lab at the college has about 30 computers. And the students have occasional access to these computers, especially during classes. So, I asked again, do you use those computers? Almost everyone agreed that they do not because the lab remains locked except for during class time, the computers are too slow, and

the lab is not for personal need. One of the male student participants mentioned: *'… college computer gula ekdom slow. Khulte pray 10 minuter upor time ney. Ar pray shomoy-e internet kaj korena. Internet o khub slow. Kaj kora shombhob. Ar tachara oi lab ta to talabondho thake. Official proyojon ba class na thakle khula hoy na.'* ('The computers at our college lab are too slow to work on. They take about 10 minutes to boot up. Besides the internet is very slow and doesn't work most of the time. It is impossible to work on these computers. Besides it is locked most of the times unless there is some official work or class').

During the interview, we discussed whether the participants were happy with their devices. The assumption was that being unhappy with their phones could may be a barrier to accessing eHealth. When asked, 32 respondents (19 male and 13 female) were found to be happy with their mobile phones and the rest were unhappy. Both the happy and the unhappy group had either smartphones and/or regular phones. It was not that only the regular phone owners were unhappy because they wanted smartphones. Happiness was a compromise made based on affordability. In some cases, unhappiness came from the will to switch to a smartphone or to a better smartphone. No one who mentioned their devices' ability to navigate health information or services could mention any health portals. In some cases, reasons for happiness referred to their phones' technological ability to take photos, offer games, show movies or Facebooking. One of the male participants mentioned: *'… ei je dhoren amar hater phonta te ami shontushto na. Eita diya chobi tula jay na, game khela jay na, majha majhe button o kaj kore na. Bibhinno bishoye jante gele bhalo phone dorkar hoy ar tar jonno lage taka. Taka hole ami obosshoi bhalo ekta Samsung phone kinbo'* ('… for example, my phone cannot take picture and I cannot play games. Sometimes, its buttons do not work. If you want to know about different things, you need a good phone. And that requires money. If I could afford it, I would have bought a Samsung phone').

It was evident from the discussion that the affordability of technology was not limited only to the cost of switching to a new phone or having a fancy smartphone. It was also related to internet use, sending SMS messages and talk time for voice calls. Especially in the case of internet use, considering the cost, most college students were interested in spending their time and money on social networking rather than looking for any information or services, let alone health. As one of the male participants mentioned:

'… internet-er dam emnitei beshi. Joto tuku pai, sheita diya amar kajer jinish dekhi. Jemon dhoren facebook kori. Oi khane onek kichu shikha jay dekha jay.' ('Internet is expensive. Whatever allowance I get, I prefer to spend it for my work. For example, on Facebook. One can learn and watch many things on Facebook'). In addition, some mentioned the cost related to using call centres. Although nobody could mention any health portals, all of them were aware of the existence of various health call centres especially the network-run ones. One of the female student participants said: *'… shob ta tei taka lage. Amra shikkharthi, taka pabo koi? Ar call center sheta teo taka lage. Ami to jibone shastho sheba nei nai phone diye. Tateo nishchoi onek taka lagbe. Kokhono ora lukay taka ney.'* ('Everything needs money. We are students, where would we get money from? And call centres, that needs money too! I have never used health services with my phone. I am sure that's very expensive, too! Sometimes they have hidden costs.')

7.4.4 Perspective of the Use of Technology for Seeking Information

In previous sections, participants have repeatedly mentioned the perceived purpose which has influenced their use of technology, e.g. browsing Facebook to communicate with their friends or using Skype to talk to their relatives Kleine has described this as an opportunity provided by ICT to achieve perceived well-being (Kleine, 2013). What about the college students of Mirzapur? Do they find using ICT for seeking information to be beneficial for their well-being? What is the most popular way of seeking electronic information for them? How do they consider the accuracy and trustworthiness of the information? How much does the privacy electronic information matter to them? The discussion started with exploring their experience of performing the task.

All the participants mentioned that they enjoyed performing the tasks. However, no one talked about the help they needed. Twenty-nine participants (17 male and 12 female) found the call centre task particularly inspiring. They explained that making voice calls was easy and available 24/7. However, on practical grounds, they preferred not to use it on a regular basis due to financial concerns, especially the potential cost associated with long waiting times. One of the male participants said: *'… mobile-er maddhome shastho sheba kintu bkhub bhalo ekta podokkhep! Apnar dorkar hoilei call diben, daktar dhorbe. Kintu ashole ki tai? Eta te taka to double lagbe, ekbar call korte abar visit dite. Tarpor chikitshay kaj na hole ki korbo? Tara ki taka ferot*

dibe? Abar Jodi report dekhaite chai tahole?' ('Health services through mobile phone is a great step. One can call when needed and the doctor will answer. But is it really like that? I think it will cost you twice; once for the mobile call, the other for the doctor's fee. What if the medicines do not work? Will they pay me back? Will they charge me again if I only want to consult the reports?') Most of the female participants also thought it was a great service but may not be effective enough compared to regular care-seeking. So, I asked: why not? One of the participants said: '…*Mobile-e sheba khub e bhalo kintu kotha bole daktar na dekhale shomossha bujhabo kibhabe.'* ('Mobile based health is great, but how can you consult a doctor if you do not talk to him face to face?')

The discussion about seeking health information through electronic platforms did not reveal any specific pattern. Six of the participants (four male and two female) mentioned that seeking health information and/or services through mobile phones over the internet is much easier and it is trustworthy, too. But one thing was clear: participants do not believe in assessing the quality of the information through further searching or by evaluating the website. However, they had their own way of assessing trustworthiness. According to the participants, SMS and call centres were considered to carry the most trustworthy and accurate information because they were often certified by a formal and recognised entity, e.g. government SMS, network-run call centre etc. In addition, sometimes checking the information with relatives or peers can also serve as a mean to determine the trustworthiness and accuracy of electronic information. One of the male participants said that: *'… SMS-e jokhon shorkar tottho pathay, oita bisshashjoggo. Jokhon make shorkar theke call kore tottho dey oitao bisshash kora jay. Kintu er baire kichu dekhle ba porle ami age amar porichito manushre jiggesh kori, tar poramorsho nei. Tara tader obhiggota diye amake shothik poramorsho dey.'* ('When the government sends an SMS or calls, that's believable. But if I see or hear anything outside this, I usually discuss this with my relatives and friends who have had similar experiences. They can advise me based on their own experience'). Female students thought it always better to check with their mothers and friends about the quality of any health information, be that from a call centre, the internet, the TV, the government or a NGO. The discussion I had with these students on ethics and the security of personal data was very short. No one knew what that meant. However, all agreed that the government

can collect and store their information. A common example given by many of the participants was the national ID card where the government stores personal information. Although everyone stressed that there should be a specific strategy and approach to ensure safety and security of personal data, none could suggest anything specific to achieve that.

7.4.5 Perspectives Regarding Networking Through Social Media

There are two reasons for discussing participants' perspectives on social networks: a. the latest addition to the dimensions of eHealth literacy explains that one of the ways in which people can get access to health service and information is through social networks; eHealth literacy 2.0 (Norman, 2011). A recent conference proceeding on the analysis of public health information from the Facebook walls of 153 organisations shows increasing trends in public engagement with sharing public health information, especially in the form of photos and links (Straton et al., 2016). Another study reported Facebook to be a great source of health information, making over 100,000 American users aware regarding the Zika virus pandemic (Sharma, Yadav, Yadav, & Ferdinand, 2017). Facebook has also been reported as an effective sample recruitment platform for mental health research (Kayrouz, Dear, Karin, & Titov, 2016). Facebook *'likes'* have been reported as an effective means for public health surveillance for mortality, diseases, and lifestyle behaviour in 214 counties across the United States and in 61 of 67 counties in Florida (Gittelman et al., 2015). b. In a recently published paper looking at violence and safety among children, Facebook has been described as the most popular platform for social networking among young students in Bangladesh (Soron & Chowdhury, 2016). So, it seemed logical to explore college students' perspective of Facebook as a source of electronic health information and services and how it influences their access to eHealth and mHealth.

Most of the college students had Facebook accounts, hence it was very easy to initiate the discussion about Facebook and how it influences access to eHealth and mHealth. The discussion started with this question: how do the participants access Facebook, is it easy for them, is it popular etc.? Almost everyone who had a Facebook account or who had ever tried to access Facebook did it through their mobile phones. Almost everyone had seen their friends doing the same. It was clear that Facebook was

a popular means for social networking. But why? According to 51 participants, Facebook was very popular because it could be accessed with as low as taka 1.5 (26 megabytes) which lasted for three days. Sometimes it could be accessed for free. All anyone with a smartphone had to do was download the app and start using it right away, either with an email account or a phone number. Therefore, it was not only financially cheap (internet-wise), it was also very easy to register and use. Almost two-thirds of the participants claimed that they were very comfortable using Facebook. Many of them had shared pictures, chatted, written status messages, sent friends requests, interacted with their peers' posts, or subscribed to different pages etc. They freely showed me their accounts and some of their past interactions. For almost everyone, the most common patterns of interaction were either social or political, ranging from communicating with an old friend who had come to town or about a popular political event. Other than this, only one or two participants could remember sharing an info page, to which they had subscribed, within their Facebook network. One of the male participants mentioned that: *'… Ami onek din dhore Facebook use kori. Ami shadharonoto Facebook-e like dei, comment kori. Eta bhalo lage je Facebook er maddhome friend-er sathe kotha hoy ebong tader photo-o dekhte pai. Tobe er baire onno kichu kori na.'* (I have used Facebook for a long time. Usually I post pictures or send likes to others. I can see my friends' photos and updates. But I do not do anything else.) Many of the male and female participants shared similar opinions and similarly limited their Facebook usage.

While the overall confidence level of the participants in using Facebook was average, it was poor for targeted use; i.e. sharing any page of interest. It was found that about four to five people (mostly male) were very confident in using Facebook and the rest were hesitant and had asked for help from their *expert* friends for troubleshooting at different times. The discussions on troubleshooting was particularly helpful for understanding why some of the participants failed to complete the Facebook task because it highlighted that often they get help from their friends (this was not the case during the performance of the tasks) Nineteen participants (12 male and seven female) failed to complete the task even with help.

And being able to handle Facebook and help others was also a sign of smartness. To some, all the popular boys and girls have smartphones and Facebook and it not uncommon to find them in the

centre of crowds. One of the female students mentioned: *'… ami to temon bhalo bhabe Facebook use korte parina. Amar bandhobi ache ekjon, o pare. Amar problem hole o thik kore dey. Kintu shobai line diya thake or pichone. Majhe tai oke college e na dhore or bashay giya thik koray nia ashi.'* (I cannot use Facebook fully, one of my friends can. So, when in trouble I go to her. But everyone else in the college also does the same. That's why I sometime go to her house to fix my Facebook problem. It is harder to get her in the college.) I find this the real scenario of the educated young people's agency in Bangladesh in relation the access to and use of eHealth. This reflects the influence of one's social capital in shaping the conversion factor that helps to convert resources into functionings.

In order to further understand young people's use of eHealth, it was necessary to examine how they generally engage with advice. I wanted to understand their pattern of engagement with professional and non-professional advice. However, none of the participants could remember receiving formal or professional advice through electronic means, except for occasional posts from the Facebook pages they subscribed to. While these pages were of diverse interest (e.g. entertainment, fan page to official pages of government and political parties), the closest to health was lifestyle (regarding beautification, exercise diet etc.). When asked: 'what do you do when you get advice?' the most common response was: 'I read it, try to follow it or act on it and if it's interesting, I sometimes share it on my wall or on my friends' walls'. However, only a few students could show such examples of sharing. And what they shared was not usually related to professional advice. One of the female participants stated: '… *Facebook-e onek dhoroner upodesh ashe, tottho ashe. Ami majhe porar cheshta kori. Kichu buhji kichu bujhi na. To tottho jai hok na keno, oita aro bhalo bhabe ghata hoy nai. Share-o kora hoy nai. Majhe moddhe shoundorjo chorcha niye nanan dhoroner upodesh ashe. Sheigula porar cheshta kori, majhe share-o dei. Abar bondhuder moddhe alochonao kori. Kintu shotti mittha jachai kora hoy nai.*' (I get many advices and information on Facebook. I try to read and understand these sometimes. But I have never shared these or tried to explore more. Sometimes I get beauty tips which I have shared or have discussed with my friends. I have never tried to explore these further to assess the truthfulness.') Most of the participants, both male and female, who have used Facebook shared similar views. This holds great potential for social network-based eHealth solutions that can reach this critical group. This can be

an ideal approach to help influence one's conversion factor to help someone to use their phones or computers to access eHealth for healthcare, equitably.

7.5 Discussion

This chapter explores the attributes of access to eHealth by the owners of electronic devices. It examines young peoples' perceptions of technical skill and health information through electronic platforms and their actual ability to navigate the electronic landscape through the application of the eHealth literacy model. Findings indicate that technical skill to access eHealth is not merely the ability to navigate devices but also to navigate various platforms. In the eHealth Literacy model this has been discussed as media literacy (Norman, 2011; Norman & Skinner, 2006). Without the ability to use electronic devices, one cannot access eHealth. In addition, it is also important to have the ability to use various electronic platforms: internet, call centre navigation, SMS etc. And to be able to access eHealth, one need technological skills as well as a general understanding of information, media and last but not least, health itself. However, as this chapter shows, young people's perception of their own technical skill is much higher than their actual skill. In contrast to their perceptions, their ability to navigate devices and electronic platforms was low. This challenges the current practice of using the wealth of information that report perceived skill to use electronic information and inferring that self-reported skill is indeed an accurate indicator of technology use. It also signposts the danger of inferring perceived skills from other domains (e.g. mobile wallet) as the ability to access eHealth, as many have done (Alam et al., 2017; Mehl & Labrique, 2014; Rajan et al., 2013; Tran et al., 2015).

The chapter also shows how perceptions of information and of various electronic platforms can influence young peoples' technical skill; the difference between observed and actual eHealth literacy. This is not a new knowledge in health research. A vast pool of literature about knowledge, attitudes and practices regarding public health interventions shows how perceptions can influence peoples' use (Bush, Stahmer, & Connelly, 2016; Heid, Knobloch, Schulz, & Safdar, 2016; McLaurin-Jones, Lashley, &

Marshall, 2017). Thus, this chapter not only describes the ability of the educated young people of Mirzapur to use a device but also examines their perception of health and usefulness of care seeking through electronic means. And keeping issues like sexuality as private as possible, often miles away from the younger generation, is a very contextually rooted practice in a semi-urban Bangladeshi community. This explains, even with the knowledge of eHealth and mHealth services and information, why young people did not use their devices to access them. In addition, having healthcare on the doorstep (in this case the presence of Kumudini hospital) is also an important factor that can influence the use of eHealth.

In addition to general knowledge about health, peoples' perceptions about the quality of eHealth and mHealth services also play important roles in deciding if they are going to access these services. The perceptions about quality were not only related to whether the information or services were trustworthy, but also related to the platform the service or the information was accessed through. This bears particular importance to current eHealth and mHealth approaches. For example; lifestyle interventions were perhaps more acceptable through social networks where peers can attest to their validity and relevance (Waldman et al., 2018).

Finally, the chapter also discusses financial affordability to be another factor involved in accepting eHealth and mHealth services and information as a potential option for care seeking. Often discussions about financial affordability are fixated on the expenses related to affording a smartphone or subscribing to the internet. However, call centres can also be unacceptable due to financial reasons. Thus, accessing eHealth and mHealth services can depend on a combination of technical skill, experience of using electronic platforms and perceptions of health and information.

This chapter examines research question three, which asks: what skills do people need to be able to use technology to access healthcare and information, and how do these skills differ in terms of individuals' perceptions and actual skill levels? In exploring how individuals' and/or groups' agency influences access to healthcare through technology, this chapter has examined people's capacity to use eHealth services, using various dimensions of eHealth literacy as the conversion factor. As is clear in the initial literature review (Chapter Two) and the conceptual framework (Chapter Three and Figure 3.3)

used in this research, technological skill has been seen as an uncomplicated dimension which people either have or not, and people's eHealth literacy results from the interplay between individual agencies and structural factors. This chapter has challenged this assumption, showing that a far more complex and nuanced understanding of technical skill is necessary if we are to understand why some people are able to use eHealth and why others do not. Rather than viewing technical skill as a one-dimensional characteristic which people either have or do not have, regardless of their positions in society, or of the context in which they are using technology and seeking healthcare, this chapter argues that it makes more sense to conceptualise skill as a complex socio-personal interaction with cultural preferences. Moreover, the chapter demonstrates that the marked difference between people's perception of their eHealth literacy and their actual ability to navigate technology and information has real implications in their search for good health. For these reasons, this chapter disaggregates the notion of technical skill, providing a fine-grained analysis of people's experience of using various electronic platforms, and the ways in which they operate electronic devices in conjunction with their experience of using information (including the quality and availability of this information) for health-seeking.

This research began by asking 'To what extent are electronic platforms and access to mobile phones and the internet affecting (reducing or increasing) disparity in access to healthcare for the people of Bangladesh? In order to address this, each of the past three chapters has examined a particular aspect and research question. Chapter Five examined how socio-demographic factors such as age, gender, education, SES, personal and household ownership of mobile phones in a semi-urban community in Bangladesh affects access to healthcare through electronic means. Chapter Six explored the role of personal agency, technological skill and electronic device ownership in relation to the use of eHealth and this chapter, Chapter Seven, has interrogated the concepts of technical skill and eHealth literacy. In the final chapter, I draw together the central findings of these three chapters and revisit the original conceptual framework which shaped this research. This, in turn, leads to a revised conceptual framework which, I argue, better elucidates the criteria for examining people's use of technology to access healthcare and related information.

Chapter 8 | Equity Implications of eHealth: A Framework of Access to Healthcare Through ICT in Bangladesh

Alain Labrique, professor and director of the Global mHealth Initiatives, when asked about the existence of the digital divide and its impact on digital health, stated in an interview with Lancet Digital Health: 'It's a matter of the lens that you choose to take. I'm a little cautious about using words like "leaving [people] behind", because I think that frames it in a very negative view. Flip the interpretation… to consider 50% of the world has access to internet. That is a phenomenal accomplishment' (Makri, 2019, p. e204). In a discussion with Skye Gilbert, deputy director of the Digital Health Solutions programme at PATH, a US-based non-profit organisation, she expressed a rather cautious and more critical view. She explained: 'Digital is fundamentally an amplifier. It can be used to exacerbate inequities. But it can also be used to bridge and support increasing progress towards equity' (Makri, 2019, p. e204). From a critical and realistic viewpoint (and not solely from an academic one), the question – of whether technology is making the health disparity worse or not – remains. Labrique adds: 'I haven't seen any evidence that suggests this' (Makri, 2019, p. e205). He then stressed the importance of continued monitoring to see how technology is influencing health disparity. On the other hand, Gilbert explained further that, while putting the aspects of the digital divide on the global agenda is encouraging, it is absolutely crucial to document the impact of the digital divide on access to healthcare. The romantic picture painted by the technocentric and techno-enthusiasts may be empowering but certainly not revealing of the troubled reality in which, despite a wealth of available eHealth opportunities, many people still struggle to maintain good health (Makri, 2019). This thesis adds to this global discourse by providing evidence of how the dimensions of technology are interconnected with access-related disparity in health.

This thesis operationalises the capability approach in analysing the role of technology in order to understand inequalities in access to healthcare and related information. It applies a bottom-up approach and related techniques to understand the interaction of people's agency and provision of eHealth services, which together influence the use of these services by people. It begins by applying conceptual insights

from the capability approach and choice framework to examine sequentially who uses eHealth and the corresponding patterns of individual preference, perception and practice associated with the use. This presents the equity implications of eHealth for access to healthcare and information in Bangladesh and related contexts. As represented by the research questions, the sequence of the inquiry is: who owns electronic devices, who uses them for eHealth to access healthcare, how are devices are being used and why? In this final chapter, I review the research findings, what I learnt in the process and how this learning contributes to the enhanced understandings of eHealth, access to healthcare and related inequity in low- and middle-income countries.

8.1 Theoretical Considerations Relevant to the Use of eHealth to Access Healthcare

This research was inspired by a literature review (Chapters Two and Three) and conceptual framework (summarised in Figure 3.3). This informed the three research questions, which asked:

1. How is access to (use and awareness of) healthcare through electronic means affected by socio-demographic factors such as age, gender, education, SES, and personal and household ownership of mobile phone in a semi-urban community in Bangladesh?
2. What combinations of personal agency determine the use of eHealth and how do these interact with electronic device ownership and technological skill?
3. What skills do people need to be able to use technology for accessing healthcare and information and how do these skills differ in accordance with individuals' perceptions and actual skill levels?

The findings of this thesis demonstrate that owning a phone or a computer does not necessarily mean access to eHealth services. Rather, people's use of eHealth is influenced by several diverse factors. Having a phone or computer is the primary step towards its use yet technical access is shaped by a range of personal and social factors, including individual skills, which interact and influence access to eHealth. Before discussing how these different factors come together to enable owners to use their devices to

access healthcare and information, I revisit the conceptual framework (Chapter Three, Figure 3.3) which informed this research and the research questions.

8.1.1 From Conceptual Framework to Empirical Evidence

In Chapter Three, after reviewing the literatures and related theories, I presented my assumptions as the conceptual framework (Figure 3.3) that was applied in this thesis. It showed that for someone with access to technology (owner of devices) to use eHealth, a certain type of capacity called eHealth literacy is required. This is essentially a combination of knowledge and ability regarding health, technology and information and general literacy. The conceptual framework posited that eHealth literacy is related to certain socio-demographic factors and to an individual's personal ability to use technology (using either a phone or computer) as well as to the eHealth landscape including related policies and practices (structural factors). This conceptual framework depicted my assumption that, in a certain eHealth landscape, certain elements of personal agency (socio-demographic and technical skill) lead to a person attaining an ability called eHealth literacy which enables him or her to use phones and/or computers to access eHealth. This combination of factors ensures one's access to healthcare and information in ways that contribute to achieving good health.

The conceptual framework was right in pointing out that individual agencies like age and education are important factors for people with access to technology (owners of devices) in enabling them to use electronic platforms for accessing healthcare and related information. In Chapter Five, I addressed research question one, exploring who in Mirzapur has access to technology. This chapter showed that college students were the most appropriately positioned to use eHealth considering their young age and education compared to rest of the population groups.

The conceptual framework also highlighted the role of individual agency in accessing and using eHealth and correlated this with the technological skill required to do so. Chapter Six thus examined research question two and shows how the college students with higher technical skill in operating a device also have greater scope to access eHealth. According to the conceptual framework, socio-demographic

profile and technical skill are the most important factors which, together with an appropriate eHealth landscape, comprise the eHealth literacy required to be able to access healthcare and information electronically. But as this research progressed, it became increasingly clear that this was not the case in reality. The findings detailed in Chapter Six demonstrated that, while skill to operate a device (commonly referred as technological skill) is important to be able to use eHealth for healthcare and information, it is not enough.

Chapter Seven addressed research question three, showing that eHealth literacy is a much more complex ability than is generally communicated in the literature and that there are often discrepancies between what people think their skill level is, and what their actual level of eHealth literacy is. This has particular methodological importance especially in terms of understanding eHealth readiness for a context like Bangladesh; a. this can help in operationalising technology-related skills for related future research using a bottom-up approach and b. it offers a critical perspective to the ongoing efforts to integrate technology exposing factors that can hinder its optimal impact. This finding represents a departure from the conceptual framework, as initially envisaged, as this did not recognise the importance of people's perceptions of skill and of health as factors influencing electronic care-seeking.

We live in an era when smartphones and smartwatches can record pulse and cardiac rhythm; some can perform blood analysis; almost all of them can paint a picture of the movements and lifestyle of the person who owns them. Every now and then we get news about what technology can do to improve health. What we do not see is what people think about technology in regard to their health needs. People can have two types of need regarding healthcare in everyday life: information and advice. *Information* is when we need to know who we should talk to for our health issues, where should we go to get treatment, how much it may cost etc. *Advice* is generally provided by a healthcare provider as in management of a disease or precondition. People's perceptions have a strong influence on both information and advice. Evidence relating to healthcare-seeking behaviour and people's diverse explanatory models of illness shows that, in Bangladesh, members of the community have their own perceptions of illness and of which providers should be consulted when in need. As a result, village

doctors are often the first line of choice for those seeking care for many childhood illnesses and basic health services (Iqbal et al., 2009; Mahmood et al., 2010). Healthcare-seeking is also influenced by social environment and interpersonal relationships. It is not uncommon that, in times of need, people look for suggestions from social networks, from friends and relatives. While technology has a lot to offer for the use of eHealth, it is important to recognise that existing eHealth initiatives are viewed as an alternate and/or additional channel for accessing health-related information and advice. As this thesis indicates, in Mirzapur, eHealth was less preferable than or perhaps 'beaten by' the *Kumudini* Hospital and *Upazila* Health Complex. In addition, eHealth is yet to be accepted by the community and thus it is yet to be part of people's explanatory models of illness and healthcare-seeking. Chapter Seven shows that people's perceptions of health and related care-seeking is an independent factor that works alongside access to technology (ownership/subscription). Thus, the initial assumptions of the conceptual framework may fall short, at least partly.

The conceptual framework presented in Chapter Three viewed eHealth literacy as an intermediate step between access to technology (ownership of a device) and access to healthcare. The framework also shows that; a. eHealth literacy is a combination of peoples' agency and related structural factors and b. this eHealth literacy is influenced by a number of socio-personal factors such as general and health-related literacy or ability to engage with technology and information. Given the findings of Chapter Seven, the conceptual framework seems to have been less explicit about the interconnectedness of human agency, related structural factors and individual experience and perception of health, technology and trust (Figure 8.1). Based on the findings from Chapters Five, Six and Seven, it is evident that when people's perceptions are influenced by the growing use of technology in their everyday lives (which can help them to develop necessary skillsets and create a favourable landscape for its use), it influences their conventional healthcare-seeking, resulting in the use of eHealth to access healthcare and information. Chapter Six examined technical skills which relate directly to the use of technological devices and not to the content being delivered by these devices. However, as shown in Chapter Seven, the skill that helps to shape eHealth Literacy and enables those with access to technology to use eHealth, is the ability to interact with

information and engage with technology. When these two abilities team up with the perception that technology can provide better healthcare and related information, people with access to technology attain a functional eHealth Literacy that can help them to access eHealth.

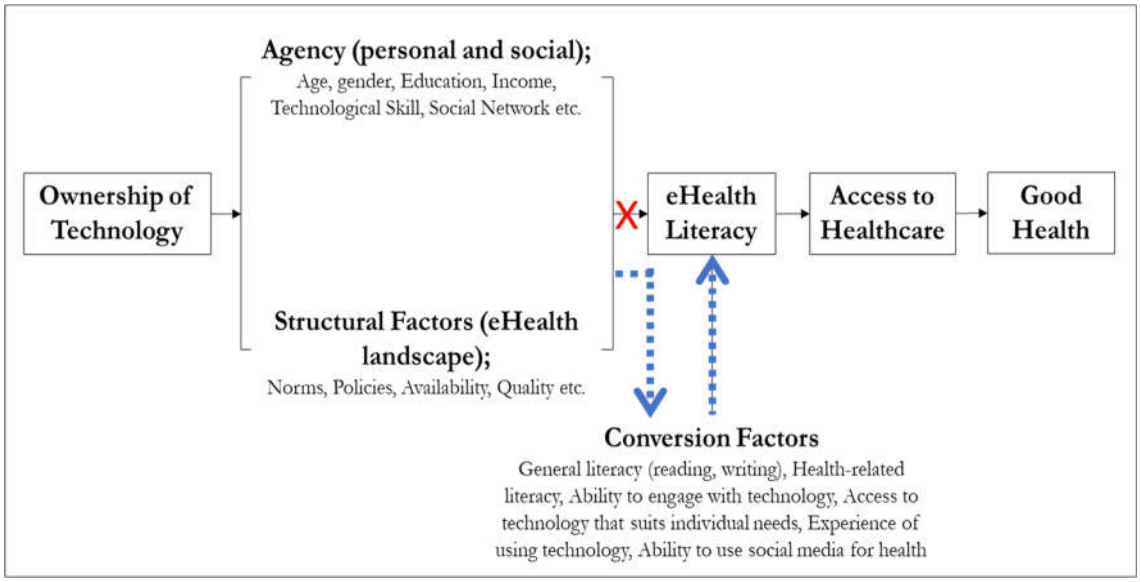


Figure 8.1 Revised Conceptual Framework Based on the Findings from Chapters Five, Six and Seven

Considering the limitations of the current literature on eHealth and of the conceptual framework that informed this thesis, a new framework can be devised to explain how people with access to technology use technology to access healthcare and information. Since this proposed framework is based on peoples' preferences, practices and views, it provides a bottom-up way of conceptualising eHealth Literacy and the use of technology for healthcare and information.

8.1.2 A Bottom-Up Framework Explaining Factors Affecting the Use of eHealth

Based on the literature review, the initial conceptual framework presented eHealth literacy in terms of six factors which, altogether, help people with access to technology use their devices to access eHealth. Based on the findings of this thesis, there are three additional levels that help an owner with healthcare needs to use his or her electronic device in a step-by-step manner; namely, immediate, intermediate and distal factors (Figure 8.2).

a. *Immediate factors* are the first level of attainments for an owner of a technical device for eHealth literacy. These are two types of literacy; one related to information and the other to technology.

Owners' experience of using information helps them to develop an understanding about; 1. the quality of electronic information and 2. its availability through electronic means. Experience with technology helps an owner to be able to; 3. operate an electronic device(s) for a purpose (technical skill) and 4. function through various electronic platforms like websites, social networks, audio-visual means, where information is available.

b. *Intermediate factors* are the second level of attainment for an owner to be able to use his/her device to access healthcare through eHealth. The quality and availability of electronic information may lead to a perception that electronic means are beneficial for seeking services and information (first immediate factor), when owners with some understanding of the quality of electronic information can assess the quality themselves and with the help of their peers and social networks. This perception is simultaneously related to the owners' ability to understand that information is and can be available through electronic means, and one can interact with the content and can differentiate between various *ePlatforms*. The second intermediate factor is when an owner develops the full technical skill to operate various *ePlatforms* for information. It is the sum of ability to operate a device and also use of various types of platforms where information is available.

c. *Distal factors* are the final step in an owner's ability to develop the required eHealth literacy to use eHealth to access healthcare. These are fairly straightforward; 1. the ability to engage with technology which comes from technical and information-related skill and also financial affordability of accessing electronic platforms, 2. the ability to interact with information for a purpose which is based on the perception that *ePlatforms* are beneficial for the intended purpose and 3. the perception that *ePlatforms* are beneficial for seeking health related information and services. The last distal factor is related to the owner's perception that *ePlatforms* are beneficial for information and health-related knowledge, alongside the attitude and practice of the owner and understanding his or her ability to make health-related decisions using information.

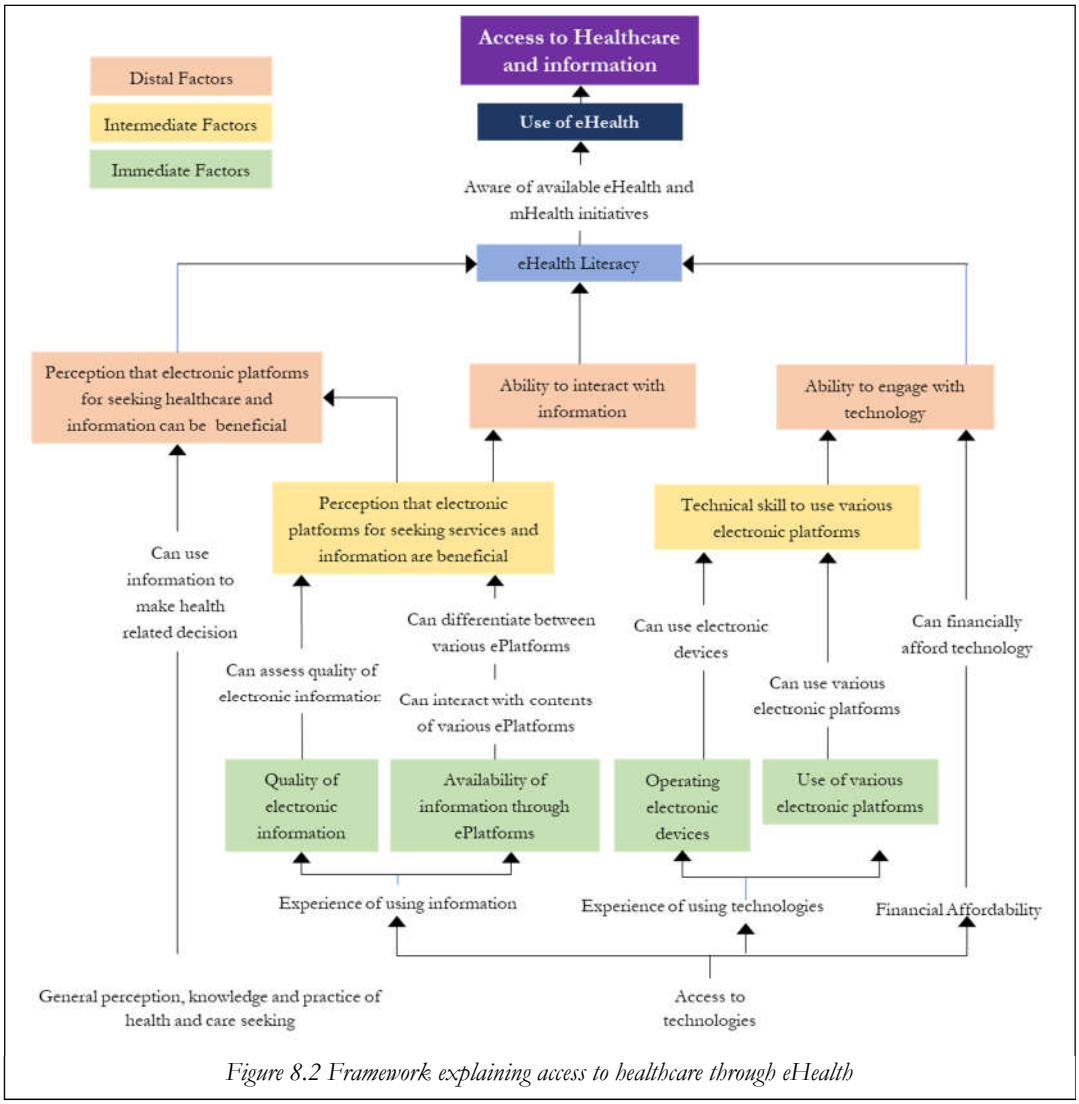


Figure 8.2 Framework explaining access to healthcare through eHealth

Figure 8.2 shows that these three factors (immediate, intermediate and distal) adding up to eHealth literacy, which helps the owner of a device to access healthcare (information and/or services) using eHealth. This revised framework begins with two assumptions: people have their own understanding of health and they have access to technology. Now if we look at this conceptual framework, the building of eHealth literacy begins with structural factors and agency resources which in turn contribute to the stages of development of eHealth literacy. However, one interesting fact about eHealth literacy is its relationship with socio-demographic determinants. In the revised framework, this can be seen as the: a. financial ability which often refers to one's individual and family related agency, b. perception of technology and information which is often related to one's individual understanding based

on experience and related worldview and c. general perception about health which related to individual, family and community related agency.

8.2 Practical Application of the eHealth Literacy Framework to Address Access-Related Health Disparity

The scientific curiosity that led me to undertake this research and write this thesis was a desire understand how to address access-related health disparity through the use of technology. This is of particular interest to 21st century public health stakeholders and enthusiasts. As a research interest it made perfect sense; the world is haunted by growing disparities in access to health, and technology has been a proven development solution in extending services as well as improving coverage and access. However, the opinions presented at the beginning of this chapter shows that experts are also unsure (explicitly or implicitly) about whether introducing technology to tackle health-related disparity can, in turn and ironically, promote disparity in access to healthcare.

To what extent, then, has this thesis been able to contribute to this discourse? While I consider technology to be a potential tool and believe in its usefulness in improving access to healthcare, I have assumed a technocritical role to understand who (in terms of individuals and groups) uses technology to access healthcare information and why. My findings provide evidence that one cannot address the question of whether technology increases – or addresses – health disparities by looking only at the technology. Rather, this thesis presents a complex and nuanced picture of how technologies interact with a range of socio-demographic attributes, with diverse skills and with wider landscapes to inform people's health-seeking patterns. This thesis is also helpful to experts who think the ongoing endorsement and integration of technology in health needs to be carefully watched. In the following sections, I examine in more detail how this thesis contributes to the existing discourse and informs future steps for health and technology and relevant policy and research direction.

8.2.1 The Challenge of Implementing Technology as Solutions to Improve Disparity Related Access to Healthcare

The finding of this thesis shows that, in the current context, access to technology is not a major concern for Bangladesh. However, use of technology to access healthcare and information by the people is very limited. This is in line with previous work in Bangladesh and in other countries. It is very important to understand that while Bangladesh has gradually worked its way out of a digital divide in regard to access to technology, this is not the case for access to eHealth. At this point in time, based on the evidence from this thesis and previous work, it seems that policy makers and experts have been assuming that access to technology is a proxy to access to eHealth for services and information. This is a mistake or misinterpretation of the growth of technology for health that can be catastrophic for the countries like Bangladesh which have low levels of resources and where health-related disparity is a major concern and a threat to universal health coverage. The evidence detailed in this thesis corresponds with a long list of work which reaffirms the theory of diffusion of innovation in many contexts. In keeping with this literature, it is expected that any innovation will take time to diffuse through a society and will need time to produce mass impact. If this was a luxury item, then the product could be available in the market for those that can afford it and others, who cannot afford these purchases, can wait till the price comes down. But healthcare should not be a luxury item, and when considering, for example, antenatal care for pregnant women, we cannot afford to wait while some women have access and the others do not. The evidence presented in this thesis thus settles the confusion about whether technological solutions for improving access to healthcare and information can also, ironically and perhaps unintentionally, intensify health disparities. The answer is unequivocally yes, it does. No matter what we do or say, as we speak, implanting eHealth solutions to extend coverage will reach the tech-enthusiast Bangladeshi, namely the young and educated adults who have the skills to interpret information and engage with the technology. Based on the evidence regarding the digital divide (Khatun et al., 2014; Rahman et al., 2017), one may also surmise that the number of tech-savvy young people will be much higher in urban areas than in sub-urban or rural areas. Thus, it is important for policy makers and public health experts to acknowledge that health-related disparities continue despite, or perhaps because of, widespread access to technology.

They also need to recognise that access to technology and access to eHealth are not synonymous and we are still a long way away from technology being able to produce its much-anticipated results in extending coverage of healthcare and improving access-related health disparities.

8.2.2 Role of Technology Skill in Ensuring Use of eHealth

Chapter Six illustrated the misperception that technological skill in using electronic devices enables people to access electronic services and demonstrates how the use of tech-solutions can vary from service to service. This may have been another reason why many policy makers and experts have not yet recognised the shortfall of eHealth initiatives in reducing health-related disparities. The evidence from this thesis shows that the use of technology can be dependent on people's health needs, both actual and perceived. The young and educated are at the forefront of promoting technology in Mirzapur, Bangladesh and are acting as diffusion agents due to their technological readiness. But health is one of the basic human needs which is intricately related to personal and social living experience (and individuals' worldviews), as well as to the actual/physical realisation of the need (health ailments). Unless the use of technology to meet this need is situated within this intricate personal and social web of worldview and experience, technological readiness (or skill) may fall short of ensuring the effective use of eHealth to improve access to healthcare and information. This is also evidence that, unless these sociological dimensions are addressed and people are empowered through trust-building, not only may skills be inadequate in promoting the use of technology for health, but engaging knowledge brokers (as facilitators) to help people deal with technological skill-related challenges may also be ineffective. Unfortunately, there is not enough work examining the complex, nuanced and interrelated processes that enable such integration of technological skill with these broader socio-demographic factors and contextual circumstances. Future attempts in understanding the challenges of integrating technology with health systems should use this evidence as the basis for conceptualisation of the problem.

8.2.3 Implications of Improving Access to Healthcare Through eHealth Literacy

This thesis might be considered, by some readers, as technophobic and providing 'negative' evidence to the development potential of digital platforms. Yet the intent of this work is not to suggest that just because only a few people are using technology to access healthcare and related information, we should stop investing in eHealth or digital platforms for health. Rather, the intent of this thesis is to ask how we can better understand people's limited use of technology for eHealth in order to promote its further use to and to enhance its ability to address health-related inequities. While Chapter Six highlighted the importance of conceptualising the use of digital platforms for health, Chapter Seven operationalised the capability approach to understand the use of technology (eHealth) to access healthcare. This provides evidence of how we can better investigate the personal and social dimensions of people's capacity and how these influence people's use of eHealth. Considering this, the revised conceptual framework based on people's worldviews and experiences, presented in this chapter, suggests ways to examine the implementation of eHealth initiatives through a bottom-up approach. This can help make eHealth interventions more responsive to people's needs and influence their access to healthcare and related information. In a resource-poor setting (in fact in any setting), technology is only effective if it is used. This revised conceptual framework is illustrated in Figure 8.2 which details the pathway of how owners of electronic devices can access eHealth for healthcare based on the capacities that these owners attain over time. Considering the current efforts in health system innovation, a people-centric approach is a widely accepted and actively practised way to foster sustainable improvements in access to healthcare for all. The eHealth conceptual framework presented in this thesis provides philosophical guidance for eHealth initiatives and conceptualises eHealth initiatives from people's own viewpoints; it can also ensure methodological guidance to foster digital health to reduce health-related disparities.

The Capability Approach (CA) shows a practical way to view development (and more specifically in this case, health) through people's perspectives. While it is a strength that the CA is broad enough to incorporate various domains, it is also a difficult one to operationalise because of its broad and vague nature. This thesis has operationalised the CA to demonstrate the use of eHealth for accessing healthcare.

Thus, it provides the opportunity to adopt a widely accepted *philosophical* and bottom-up approach for eHealth research and initiatives. The adoption of a nuanced understanding of eHealth literacy and its associated steps (as demonstrated in this thesis) results from the empirical explanation of why people use (or do not use) eHealth to access healthcare in Bangladesh. The key elements of this conceptual framework, as illustrated in Figure 8.2, can be communicated to policy makers, stakeholders, development actors, patients/community and practitioners as framework-based guidance that sensitises them to the importance of considering people's perspectives in relation to designing and/or implementing eHealth initiatives. It also provides opportunities for further research to understand how to speed up the diffusion of eHealth in Bangladesh, for example by understanding and engaging with the young and educated group of the society as apomediaries.

By operationalising CA, this thesis also provides a methodological solution to adopting a bottom-up approach in the field of technology and health. Figure 8.2 and the domains of eHealth literacy demonstrate the relevant indicators/themes/variables associated with a bottom up approach towards the use of eHealth. However, as this thesis demonstrates, there is always a chance of introducing biases if these themes/indicators are attempted without triangulation. Using the technique of comparing claimed and observed skills provides a means of documenting peoples' actual capacity and of assessing how this influences their use of technology to access healthcare and related information.

8.3 Conclusion

I began this research to understand how ICT can be used to ensure people's health-related wellbeing. Because of many so-called negative findings, I have often faced criticism when presenting this work, because of the rapid growth and adoption of ICT and the strong belief in its ability to resolve long-standing and intractable problems (Lucas, 2015). And I fear this research too will encounter the same criticisms and eventually will be labelled as *technophobic*. In fact, it is quite the opposite. The scientific curiosity of this thesis is entirely *technocritical,* explaining a practical way to make the best use of ICT's

potential to improve health-related disparity for Bangladesh. The interesting fact is that Bangladesh is a highly fertile ground for capitalising on the potential of ICT because of its growth over the time, political interest and multisectoral involvement. The revised framework in this thesis can really help Bangladesh to benefit from the ongoing ICT revolution by injecting an awareness of bottom-up considerations and of the importance of starting with the people themselves. At the end of the day, it will be unfortunate if, despite all the support and factors in place, eHealth turns out to be ineffective in improving access to healthcare because of a lack of use by people, in Bangladesh and globally.

List of References

A2I. (2011). *Strategic Priorities of Digital Bangladesh*. Dhaka. Retrieved from https://a2i.gov.bd/wp-content/uploads/2017/11/4-Strategy_Digital_Bangladesh_2011.pdf

Acılar, A. (2011). Exploring the Aspects of Digital Divide in a Developing Country. *Issues in Informing Science and Information Technology Exploring the Aspects of Digital Divide in a Developing Country*, *8*, 231–244. Retrieved from http://iisit.org/Vol8/IISITv8p231-244Acilar248.pdf

Adams, A. M., Ahmed, T., Arifeen, S. El, Evans, T. G., Huda, T., & Reichenbach, L. (2013). Innovation for Universal Health Coverage in Bangladesh: A Call to Action. *The Lancet*, *382*, 2104–2111.

Afroz, T. (2012). *Delivery of Mobile Phone Aided Health Services in Rural Bangladesh: A Study on Two Upazilas. Department of General and Continuing Education*. North South University, Bangladesh, Dhaka. Retrieved from internal-pdf://196.201.241.161/Delivery of Mobile Phone Aided Health Services.pdf

Agosto, D. E., & Abbas, J. (2010). High school seniors' social network and other ICT use preferences and concerns. *Proceedings of the American Society for Information Science and Technology*, *47*(1), 1–10. https://doi.org/10.1002/meet.14504701025

Ahmed, S. M., Alam, B. B., Anwar, I., Begum, T., Huque, R., Khan, J. A., … Osman, F. A. (2015). *Bangladesh health system review*. (A. Naheed & K. Hort, Eds.), *Health Systems in Transition* (Vol. 5). Manila: Regional Office for the Western Pacific (WPRO), World Health Organization (WHO). Retrieved from http://apps.who.int/iris/bitstream/handle/10665/208214/9789290617051_eng.pdf?sequence=1

Ahmed, S. M., Evans, T. G., Standing, H., & Mahmud, S. (2013). Harnessing pluralism for better health in Bangladesh. *Lancet*, *382*(9906), 1746–1755. https://doi.org/10.1016/s0140-6736(13)62147-9

Ahmed, S. M., Hossain, M. A., Chowdhury, A. M. R., & Bhuiya, A. U. (2011). The health workforce crisis in Bangladesh: shortage, inappropriate skill-mix and inequitable distribution. *Human Resources for Health*, *9*(1), 3. https://doi.org/10.1186/1478-4491-9-3

Ahmed, S. M., Petzold, M., Kabir, Z. N., & Tomson, G. (2006). Targeted intervention for the ultra poor in rural Bangladesh: Does it make any difference in their health-seeking behaviour? *Social Science & Medicine*, *63*(11), 2899–2911. https://doi.org/10.1016/J.SOCSCIMED.2006.07.024

Ahmed, T, Lucas, H., Khan, A. S., Islam, R., Bhuiya, A., & Iqbal, M. (2014). eHealth and mHealth initiatives in Bangladesh: a scoping study. *BMC Health Serv Res*, *14*, 260. https://doi.org/10.1186/1472-6963-14-260

Ahmed, Tanvir, Bloom, G., Iqbal, M., Lucas, H., Rasheed, S., Waldman, L., … Bhuiya, A. (2014). *E-health and M-Health in Bangladesh: Opportunities and Challenges. Evidence Report No. 60; Horizon scanning (Tomorrow Today)*. Brighton: Institute of Development Studies. Retrieved from https://assets.publishing.service.gov.uk/media/57a089f240f0b652dd0004a8/ER60.pdf

Ahsan, K., Ahmed, S., Angeles, G., Benson, A., Chakraborty, N., Curtis, S., … Ijdi, R. (2017). Bangladesh Maternal Mortality and Health Care Survey 2016: Preliminary Report.

Ainul, S., Bajracharya, A., Reichenbach, L., & Gilles, K. (2017). *Adolescents in Bangladesh: A Situation Analysis of Programmatic Approaches to Sexual and Reproductive Health Education and Services*. Washington DC & Dhaka. Retrieved from http://evidenceproject.popcouncil.org/wp-content/uploads/2017/02/Bangladesh-ASRH-Report_January-2017.pdf

Aker, J. C., & Mbiti, I. M. (2010). *Mobile Phones and Economic Development in Africa*. Center for Global

Development.

Akter, S., & Ray, P. (2010). mHealth - an Ultimate Platform to Serve the Unserved. *Yearbook of Medical Informatics*, 94–100.

Alam, G. M. M., Alam, K., Mushtaq, S., Khatun, M. N., & Mamun, M. S. A. K. (2018). Influence of socio-demographic factors on mobile phone adoption in rural Bangladesh. *Information Development*, 026666691879204. https://doi.org/10.1177/0266666918792040

Alam, M., D'este, C., Banwell, C., & Lokuge, K. (2017). The impact of mobile phone based messages on maternal and child healthcare behaviour: a retrospective cross-sectional survey in Bangladesh. https://doi.org/10.1186/s12913-017-2361-6

Alexander, J. M. (2008). *Capabilities and social justice : the political philosophy of Amartya Sen and Martha Nussbaum / John M. Alexander*. Aldershot, England ; Burlington, VT: Ashgate Pub. Ltd. Retrieved from http://www.loc.gov/catdir/toc/ecip0714/2007013124.html

Alston, P., & Anand, S. (2000). *Human Development Report 2000 was prepared by a team of eminent economists and distin-guished development professionals, including*. New York. Retrieved from http://www.tandf.co.uk

Anir, C. (2017). A tech revolution helps boost Bangladesh's development | End Poverty in South Asia. Retrieved June 4, 2018, from http://blogs.worldbank.org/endpovertyinsouthasia/tech-revolution-helps-boost-bangladesh-s-development

Ansari, N. L. (2010). Stories from rural Bangladesh: presenting impact of the mobile phone based 'health help line' service in rural Bangladesh. In J. Svensson & G. Wicander (Eds.), *M4D 2010: The 2nd International Conference on M4D Mobile Communication Technology for Development* (p. 15). Kampala, Uganda: Karlstad University Studies. Retrieved from http://www.diva-portal.org/smash/get/diva2:357565/FULLTEXT01.pdf

Badran, M. F. (2013). *Young People and The Digital Divide In Egypt: An Empirical Study. Working Paper*. Giza: The Economic Research Forum.

Balabanova, D., Mills, A., Conteh, L., Akkazieva, B., Banteyerga, H., Dash, U., … McKee, M. (2013). Good Health at Low Cost 25 years on: lessons for the future of health systems strengthening. *The Lancet*, *381*(9883), 2118–2133. https://doi.org/10.1016/S0140-6736(12)62000-5

Bangladesh Health Watch. (2012). *Moving Towards Universal Health Coverage. Bangladesh Health Watch Report 2011*. Dhaka: Bangladesh Health Watch, James P Grant School of Public Health, BRAC University.

Banglapedia. (2015). Bangladesh. Retrieved February 7, 2019, from http://en.banglapedia.org/index.php?title=Bangladesh

Bar, F., & Best, M. L. (2008). Announcing ITID 2.0. *Information Technologies and International Development*, *4*(4), iii–iv.

Barnes, S. B. (2000). Bridging the Differences between Social Theory and Technological Invention in Human-Computer Interface Design. *New Media & Society*, *2*(3), 353–372. https://doi.org/10.1177/14614440022225850

Bartolome, J. M. (2014). *How has India's Rapidly Growing ICT Sector Impacted its Rural Poor?* University Honors Theses, Portland State University.

BBC. (2018). Bangladesh country profile - BBC News. Retrieved June 4, 2018, from http://www.bbc.co.uk/news/world-south-asia-12650940

BBS. (2013). *Health and Morbidity Status Survey- 2012*. Dhaka: Statistics and Informatics Division,

Ministry of Planning, Government of the People's Republic of Bangladesh.

Bender, M. S., Choi, J., Arai, S., Paul, S. M., Gonzalez, P., & Fukuoka, Y. (2014). Digital technology ownership, usage, and factors predicting downloading health apps among caucasian, filipino, korean, and latino americans: the digital link to health survey. *JMIR MHealth and UHealth*, *2*(4). https://doi.org/10.2196/mhealth.3710

Best, M. L., & Maier, S. G. (2007). Gender, Culture and ICT Use in Rural South India. *Gender, Technology and Development*, *11*(2), 137–155. https://doi.org/10.1177/097185240701100201

Bigdeli, M., & Annear, P. L. (2009). Barriers to access and the purchasing function of health equity funds: lessons from Cambodia. *Bulletin of the World Health Organization*, *87*(7), 560–564. https://doi.org/10.2471/BLT.08.053058

Bircher, J. (2005). Towards a Dynamic Definition of Health and Disease. *Medicine, Health Care and Philosophy*, *8*(3), 335–341. https://doi.org/10.1007/s11019-005-0538-y

bKash. (2017). Company Profile. Retrieved April 26, 2018, from https://www.bkash.com/about/company-profile

BKMI. (2014). *Bangladesh eHealth Inventory Report*. Dhaka: Bangladesh Knowledge Management Initiative (BKMI).

Blackstock, O. J., Cunningham, C. O., Haughton, L. J., Garner, R. Y., Norwood, C., & Horvath, K. J. (2016). Higher eHealth Literacy is Associated With HIV Risk Behaviors among HIV-Infected Women Who Use the Internet. *Journal of the Association of Nurses in AIDS Care*, *27*(1), 102–108. https://doi.org/http://dx.doi.org/10.1016/j.jana.2015.09.001

Bloom, G. (2000). *Equity in Health in Unequal Societies: Towards Health Equity During Rapid Social Change. IDS Working Paper*. Brighton: Institute of Development Studies. Retrieved from https://www.ids.ac.uk/files/Wp112.pdf

Bloom, G., Berdou, E., Standing, H., Guo, Z., & Labrique, A. (2017). ICTs and the challenge of health system transition in low and middle-income countries. *Globalization and Health*, *13*(1), 56. https://doi.org/10.1186/s12992-017-0276-y

Bloom, G., Henson, S., & Peters, D. H. (2014). Innovation in regulation of rapidly changing health markets. *Globalization and Health*, *10*(1), 53. https://doi.org/10.1186/1744-8603-10-53

Bloom, G., Standing, H., & Lloyd, R. (2008). Markets, information asymmetry and health care: Towards new social contracts. *Social Science & Medicine*, *66*(10), 2076–2087. https://doi.org/10.1016/j.socscimed.2008.01.034

Boutayeb, A., & Boutayeb, S. (2005). The burden of non communicable diseases in developing countries. *International Journal for Equity in Health*, *4*(1), 2. https://doi.org/10.1186/1475-9276-4-2

Braithwaite, J., Mannion, R., Matsuyama, Y., Shekelle, P., Whittaker, S., & Al-Adawi, S. (2017). *Health Systems Improvement Across the Globe: Success Stories from 60 Countries.* (B. Jeffrey, M. Russell, M. Yukihiro, S. Paul, W. Stuart, & A.-A. Samir, Eds.). 6000 Broken Sound Parkway NW, Suite 300 Boca Raton, FL 33487-2742: CRC Press. https://doi.org/10.1201/9781315586359

Braithwaite, J., Mannion, R., Matsuyama, Y., Shekelle, P., Whittaker, S., Al-Adawi, S., … Hughes, C. (2017). Accomplishing reform: successful case studies drawn from the health systems of 60 countries. *International Journal for Quality in Health Care*, *29*(6), 880–886. https://doi.org/10.1093/intqhc/mzx122

Braveman, P. A., Kumanyika, S., Fielding, J., LaVeist, T., Borrell, L. N., Manderscheid, R., & Troutman, A. (2011). Health Disparities and Health Equity: The Issue Is Justice. *American Journal of*

Public Health, *101*(Suppl 1), S149–S155. https://doi.org/10.2105/AJPH.2010.300062

Braveman, P., & Gruskin, S. (2003). Defining equity in health. *Journal of Epidemiology and Community Health*, *57*(4), 254–258. https://doi.org/10.1136/jech.57.4.254

Briones, R. (2015). Harnessing the Web: How E-Health and E-Health Literacy Impact Young Adults' Perceptions of Online Health Information. *Medicine 2.0*, *4*(2), e5. https://doi.org/10.2196/med20.4327

BTRC. (2017). The total number of Mobile Phone subscriptions has reached 131.956 million at the end of January, 2016. Dhaka: Bangladesh Telecommunication Regulatory Commission (BTRC). Retrieved from http://www.btrc.gov.bd/content/mobile-phone-subscribers-bangladesh-january-2016

BTRC. (2018). Mobile Phone Subscribers in Bangladesh February, 2018. Retrieved April 26, 2018, from http://www.btrc.gov.bd/content/mobile-phone-subscribers-bangladesh-february-2018

Buhi, E. R., Trudnak, T. E., Martinasek, M. P., Oberne, A. B., Fuhrmann, H. J., & McDermott, R. J. (2012). Mobile phone-based behavioural interventions for health: A systematic review. *Health Education Journal*, *72*, 564–583. https://doi.org/10.1177/0017896912452071

Bush, R. A., Stahmer, A. C., & Connelly, C. D. (2016). Exploring perceptions and use of the electronic health record by parents of children with autism spectrum disorder: A qualitative study. *Health Informatics Journal*, *22*(3), 702–711. https://doi.org/10.1177/1460458215581911

Cambridge Dictionary. (2020). Context. Retrieved from https://dictionary.cambridge.org/dictionary/english/context

Camner, G., Pulver, C., & Sjöblom, E. (2009). *What makes a Successful Mobile Money Implementation? Learnings from M-PESA in Kenya and Tanzania*. London. Retrieved from https://www.gsma.com/mobilefordevelopment/wp-content/uploads/2012/06/mpesa_case_study9983.pdf

Carrin, G., Mathauer, I., Xu, K., & Evans, D. B. (2008). Universal coverage of health services: tailoring its implementation. *Bulletin of the World Health Organization*, *86*(11), 857–863. https://doi.org/10.2471/BLT.07.049387

Caruso, B. A., Sevilimedu, V., Fung, I. C.-H., Patkar, A., & Baker, K. K. (2015). Gender disparities in water, sanitation, and global health. *The Lancet*, *386*(9994), 650–651. https://doi.org/10.1016/S0140-6736(15)61497-0

Centeno, C., Cullen, J., Kluzer, S., & Hache, A. (2012). *Information and Communication Technologies (ICTs) for disadvantaged youth: Opportunities and Challenges. Evidence from literature and practice*. Luxembourg. Retrieved from http://ipts.jrc.ec.europa.eu

Chan, C. V, & Kaufman, D. R. (2011). A Framework for Characterizing eHealth Literacy Demands and Barriers. *Journal of Medical Internet Research*, *13*(4), e94. https://doi.org/10.2196/jmir.1750

Chan, C. V, Matthews, L. A., & Kaufman, D. R. (2009). A Taxonomy Characterizing Complexity of Consumer eHealth Literacy. *AMIA Annual Symposium Proceedings*, *2009*, 86–90. Retrieved from http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2815448/

Cho, J., Park, D., & Lee, H. E. (2014). Cognitive Factors of Using Health Apps: Systematic Analysis of Relationships Among Health Consciousness, Health Information Orientation, eHealth Literacy, and Health App Use Efficacy. *Journal of Medical Internet Research*, *16*(5), e125. https://doi.org/10.2196/jmir.3283

Chowdhury, A. M. R., Bhuiya, A., Chowdhury, M. E., Rasheed, S., Hussain, Z., & Chen, L. C. (2013).

The Bangladesh paradox: exceptional health achievement despite economic poverty. *The Lancet*, *382*(9906), 1734–1745. https://doi.org/10.1016/S0140-6736(13)62148-0

Chung, S.-Y., & Nahm, E.-S. (2015). Testing Reliability and Validity of the eHealth Literacy Scale (eHEALS) for Older Adults Recruited Online. *CIN: Computers, Informatics, Nursing*, *33*(4), 150–156. https://doi.org/10.1097/cin.0000000000000146

Clark, R. E., & Estes, F. (1996). Cognitive task analysis. *International Journal of Educational Research*, *25*(5), 403–417.

Coeckelbergh, M. (2011). Human development or human enhancement? A methodological reflection on capabilities and the evaluation of information technologies. *Ethics and Information Technology*, *13*(2), 81–92. https://doi.org/10.1007/s10676-010-9231-9

Comim, F., Qizilbash, M., & Alkire, S. (2008). *The Capability Approach: Concepts, Measures and Applications*. Cambridge University Press. Retrieved from https://books.google.co.uk/books?id=-BJLtasRHBsC

Crocker, D. A. (2008). *Ethics of Global Development: Agency, Capability, and Deliberative Democracy*. Cambridge University Press. Retrieved from https://books.google.co.uk/books?id=CQQkn-ndHEYC

Culyer, A. ., & Wagstaff, A. (1993). Equity and equality in health and health care. *Journal of Health Economics*, *12*(4), 431–457. https://doi.org/10.1016/0167-6296(93)90004-X

Culyer, A. J. (2001). Equity - some theory and its policy implications. *Journal of Medical Ethics*, *27*(4), 275–283. https://doi.org/10.1136/JME.27.4.275

Dafoe, A. (2015). On Technological Determinism: A Typology, Scope Conditions, and a Mechanism. *Technology, & Human Values*, *40*(6), 1047–1076. https://doi.org/10.1177/0162243915579283

Dagger, T. S., Sweeney, J. C., & Johnson, L. W. (2007). A Hierarchical Model of Health Service Quality. *Journal of Service Research*, *10*(2), 123–142. https://doi.org/10.1177/1094670507309594

Damanpour, F. (1996). Organizational Complexity and Innovation: Developing and Testing Multiple Contingency Models. *Management Science*, *42*(5), 693–716. https://doi.org/10.1287/mnsc.42.5.693

Das, S. K., Nasrin, D., Ahmed, S., Wu, Y., Ferdous, F., Farzana, F. D., … Faruque, A. S. G. (2013). Health Care-Seeking Behavior for Childhood Diarrhea in Mirzapur, Rural Bangladesh. *The American Journal of Tropical Medicine and Hygiene*, *89*(1 Suppl), 62–68. https://doi.org/10.4269/ajtmh.13-0107

Davies, S. C., Winpenny, E., Ball, S., Fowler, T., Rubin, J., & Nolte, E. (2014). For debate: a new wave in public health improvement. *The Lancet*, *In press*. https://doi.org/10.1016/S0140-6736(13)62341-7

de la Cruz Paragas, F., & Lin, T. T. C. (2016). Organizing and reframing technological determinism. *New Media & Society*, *18*(8), 1528–1546. https://doi.org/10.1177/1461444814562156

De Wulf, L. (2004). *Tradenet in Ghana best practice of the use of information technology* (World Development Report background papers 2005). Washington, D.C. Retrieved from http://documents.worldbank.org/curated/en/137601468771018721/pdf/313620GH0trade11WDR20050bkgd0paper1.pdf

Dean, H. D. (2013). Minority Health Determines the Health of the Nation | HIV.gov. Retrieved June 18, 2018, from https://www.hiv.gov/blog/minority-health-determines-the-health-of-the-nation

Dearing, J. W., & Cox, J. G. (2018). Diffusion Of Innovations Theory, Principles, And Practice. *Health Affairs*, *37*(2), 183–190. https://doi.org/10.1377/hlthaff.2017.1104

Dehlendorf, C., Bryant, A. S., Huddleston, H. G., Jacoby, V. L., & Fujimoto, V. Y. (2010). Health disparities: definitions and measurements. *American Journal of Obstetrics and Gynecology*, *202*(3), 212–213. https://doi.org/10.1016/j.ajog.2009.12.003

Deloitte. (2017). *Smart everything, everywhere; Mobile Consumer Survey 2017: The Australian cut*. Retrieved from http://landing.deloitte.com.au/rs/761-IBL-328/images/tmt-mobile-consumer-survey-2017_pdf.pdf

Deneulin, S., & Shahani, L. (2009). *An Introduction to the Human Development and Capability Approach: Freedom and Agency*. Earthscan. Retrieved from https://books.google.co.uk/books?id=vyaghkzjeJIC

Dennison, L., Morrison, L., Conway, G., & Yardley, L. (2013). Opportunities and Challenges for Smartphone Applications in Supporting Health Behavior Change: Qualitative Study. *J Med Internet Res*, *15*(4), e86. https://doi.org/10.2196/jmir.2583

Department of Health. (n.d.). Health technology | Australian Government Department of Health. Retrieved April 14, 2020, from https://www.health.gov.au/health-topics/health-technology

Deursen, A J A M van, & van Dijk, J. A. G. M. (2010). Measuring Internet Skills. *International Journal of Human–Computer Interaction*, *26*(10), 891–916. https://doi.org/10.1080/10447318.2010.496338

Devanuj, & Joshi, A. (2013). Technology adoption by "emergent" users: the user-usage model. In *Proceedings of the 11th Asia Pacific Conference on Computer Human Interaction - APCHI '13* (pp. 28–38). New York, New York, USA: ACM Press. https://doi.org/10.1145/2525194.2525209

DGHS. (2012). *Our eHealth: The Roadmap of Impressive Development*. (A. K. Azad, A. S. M. Sayem, & N. Khan, Eds.). Dhaka: Directorate general of Health Services (DGHS), Ministry of Health and Family Welfare (MoHFW). Retrieved from http://www.dghs.gov.bd/licts_file/images/eHealth/our_eHealth_Aug_2012.pdf

Dixon, L. J., Correa, T., Straubhaar, J., Covarrubias, L., Graber, D., Spence, J., & Rojas, V. (2014). Gendered Space: The Digital Divide between Male and Female Users in Internet Public Access Sites. *Journal of Computer-Mediated Communication*, *19*(4), 991–1009. https://doi.org/10.1111/jcc4.12088

Duncombe, R., & Boateng, R. (2009). Mobile Phones and Financial Services in Developing Countries: a review of concepts, methods, issues, evidence and future research directions. *Third World Quarterly*, *30*(7).

Đurek, V., & Redep, N. B. (2016). Review on e-readiness assessment tools. In *Central European Conference on Information and Intelligent Systems* (p. 161). Varaždin. Retrieved from http://archive.ceciis.foi.hr/app/public/conferences/1/ceciis2016/papers/ICT-1.pdf

ECDL Foundation. (2016). *Perception and Reality: Measuring Digital Skills in Europe*. Retrieved from http://ecdl.org/media/perceptionandreality-measuringdigitalskillsineurope-ecdlfoundationpositionpaper1.pdf

Edouard, E., Edouard, E., & Edouard, L. (2012). Application of Information and Communication Technology for Scaling up Youth Sexual and Reproductive Health. *African Journal of Reproductive Health / La Revue Africaine de La Santé Reproductive*, *16*(2), 197–205. Retrieved from http://www.jstor.org/stable/23318028

EIU. (2018). *Preparing For Disruption: Technological Readiness Ranking*. Retrieved from http://pages.eiu.com/rs/753-RIQ-438/images/Technological_readiness_report.pdf

El Arifeen, S., Hill, K., Ahsan, K. Z., Jamil, K., Nahar, Q., & Streatfield, P. K. (2014). Maternal mortality in Bangladesh: a Countdown to 2015 country case study. *The Lancet*, *384*(9951), 1366–

1374. https://doi.org/10.1016/S0140-6736(14)60955-7

Embrett, M. G., & Randall, G. E. (2014). Social determinants of health and health equity policy research: exploring the use, misuse, and nonuse of policy analysis theory. *Social Science & Medicine (1982)*, *108*, 147–155. https://doi.org/10.1016/j.socscimed.2014.03.004

Evans, D. B., Hsu, J., & Boerma, T. (2013). Universal health coverage and universal access Editorials. *Bull World Health Organ*. https://doi.org/10.2471/BLT.13.125450

Eysenbach, G, Powell, J., Kuss, O., & Sa, E. R. (2002). Empirical studies assessing the quality of health information for consumers on the world wide web: a systematic review. *JAMA*, *287*(20), 2691–2700.

Eysenbach, Gunther. (2007). From intermediation to disintermediation and apomediation: new models for consumers to access and assess the credibility of health information in the age of Web2.0. *Studies in Health Technology and Informatics*, *129*(Pt 1), 162–166. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/17911699

Faith, B. (2016). *How Does the Use of Mobile Phones By 16-24 Year Old Socially Excluded Women Affect Their Capabilities?* Open University.

Fallows, D., & Pew Internet & American Life Project. (2005). *How Women and Men Use the Internet*. Washington DC: Pew Internet & American Life Project.

Faulkner, W. (2001). The technology question in feminism: A view from feminist technology studies. *Women's Studies International Forum*, *24*(1), 79–95. https://doi.org/http://dx.doi.org/10.1016/S0277-5395(00)00166-7

Federal Ministry of Health. (2020). Driving the digital transformation of Germany's healthcare system for the good of patients - Bundesgesundheitsministerium. Retrieved April 14, 2020, from https://www.bundesgesundheitsministerium.de/digital-healthcare-act.html

Frasca, K. J., & Edwards, M. R. (2017). Web-based corporate, social and video recruitment media: Effects of media richness and source credibility on organizational attraction. *International Journal of Selection and Assessment*, *25*(2), 125–137. https://doi.org/10.1111/ijsa.12165

Fraser, H., & Wyatt, J. (2014). International Dimensions of Clinical Decision Support. In *Clinical Decision Support* (pp. 241–267). Elsevier. https://doi.org/10.1016/B978-0-12-398476-0.00008-7

Fuchs, C., & Horak, E. (2007). Informational Capitalism and the Digital Divide in Africa. *Masaryk University Journal of Law and Technology*, *1*(2), 11–32.

Galperin, H. (2010). Goodbye Digital Divide, Hello Digital Confusion? A Critical Embrace of the Emerging ICT4D Consensus. *Information Technologies & International Development*, *6*(SE (Special Edition)), 53–55.

Gerster, R., & Zimmermann, S. (2003). *Information and communication technologies (ICTs) for poverty reduction?* Geneva. Retrieved from http://www.gersterconsulting.ch

Ghosh, S. (2014). Equity in the utilzation of healthcare services in India: evidence from National Sample Survey. *International Journal of Health Policy and Management*, *2*(1), 29–38.

Gillard, H., Howcroft, D., Mitev, N., & Richardson, H. (2008). "Missing women": Gender, ICTs, and the shaping of the global economy. *Information Technology for Development*, *14*(4).

Gittelman, S., Lange, V., Gotway Crawford, C. A., Okoro, C. A., Lieb, E., Dhingra, S. S., & Trimarchi, E. (2015). A new source of data for public health surveillance: Facebook likes. *Journal of Medical Internet Research*, *17*(4), e98. https://doi.org/10.2196/jmir.3970

Glik, D., Massey, P., Gipson, J., Dieng, T., Rideau, A., & Prelip, M. (2016). Health-related media use among youth audiences in Senegal. *Health Promotion International*, *31*(1), 73–82. https://doi.org/10.1093/heapro/dau060

Gottret, P., & Schieber, G. (2006). *Health Financing Revisited*. The World Bank. https://doi.org/10.1596/978-0-8213-6585-4

Greenhalgh, T, Robert, G., Macfarlane, F., Bate, P., Kyriakidou, O., & Peacock, R. (2005). Storylines of research in diffusion of innovation: a meta-narrative approach to systematic review. *Soc Sci Med*, *61*(2), 417–430. https://doi.org/10.1016/j.socscimed.2004.12.001

Greenhalgh, Trisha, Robert, G., Macfarlane, F., Bate, P., & Kyriakidou, O. (2004). Diffusion of Innovations in Service Organizations: Systematic Review and Recommendations. *The Milbank Quarterly*, *82*(4), 581–629. https://doi.org/10.1111/j.0887-378X.2004.00325.x

Gross, M., & Latham, D. (2012). What's skill got to do with it?: Information literacy skills and self-views of ability among first-year college students. *Journal of the American Society for Information Science and Technology*, *63*(3), 574–583. https://doi.org/10.1002/asi.21681

GSMA. (2015). *Case Study: Airtel Green SIM*. London. Retrieved from https://www.gsma.com/mobilefordevelopment/wp-content/uploads/2015/03/GSMA_Case_IKSL_web2.pdf

GSMA. (2018). Comparing Agent-led versus Self-register subscription models for mAgri services | Mobile for Development. Retrieved April 25, 2018, from https://www.gsma.com/mobilefordevelopment/programme/magri/comparing-agent-led-versus-self-register-subscription-models-magri-services/

GSMA, & Cherie Blair Foundation for Women. (2010). *Women & Mobile: A Global Opportunity*. GSMA Mobiles for Development and the Cherie Blair Foundation for Women. Retrieved from http://www.gsma.com/connectedwomen/wp-content/uploads/2013/01/GSMA_Women_and_Mobile-A_Global_Opportunity.pdf

GSMA, & GCWGD Alliance. (2015). *Bridging the gender gap: Mobile access and usage in low- and middle-income countries. Connected Women*. GSMA Connected Women Global Development (GCWGD) Alliance.

GSMA Intelligence. (2014). *Country overview: Bangladesh*. London. Retrieved from https://www.gsmaintelligence.com/research/?file=140820-bangladesh.pdf&download

GSMA Intelligence. (2015). *The Mobile Economy*. London. Retrieved from https://www.gsma.com/mobileeconomy/global/2015/GSMA_Global_Mobile_Economy_Report_2015.pdf

Gulliford, M., Figueroa-Munoz, J., Morgan, M., Hughes, D., Gibson, B., Beech, R., & Hudson, M. (2002). What does "access to health care" mean? *Journal of Health Services Research & Policy*, *7*(3), 186–188. https://doi.org/10.1258/135581902760082517

Gummer, E., & Mandinach, E. (2015). Building a Conceptual Framework for Data Literacy. *Teachers College Record*, *117*(4). Retrieved from https://eric.ed.gov/?id=EJ1056711

Guraya, S. Y. (2016). The Usage of Social Networking Sites by Medical Students for Educational Purposes: A Meta-analysis and Systematic Review. *North American Journal of Medical Sciences*, *8*(7), 268–278. https://doi.org/10.4103/1947-2714.187131

Hajizadeh, M., Sia, D., Heymann, S. J., & Nandi, A. (2014). Socioeconomic inequalities in HIV/AIDS prevalence in sub-Saharan African countries: evidence from the Demographic Health Surveys. *International Journal for Equity in Health*, *13*, 18. https://doi.org/10.1186/1475-9276-13-18

Halewood, N., & Kenny, C. (2008). Young people and ICTs in developing countries. *Information Technology for Development*, *14*(2), 171–177. https://doi.org/10.1002/itdj.20093

Hargittai, E., & Shafer, S. (2006). Differences in Actual and Perceived Online Skills: The Role of Gender. *Social Science Quarterly*, *87*(2), 432–448. https://doi.org/10.1111/j.1540-6237.2006.00389.x

Hasan, M. I., Hassan, M. Z., Bulbul, M. M. I., Joarder, T., & Chisti, M. J. (2018). Iceberg of workplace violence in health sector of Bangladesh. *BMC Research Notes*, *11*(1), 702. https://doi.org/10.1186/s13104-018-3795-6

Haun, J. N., Patel, N. R., Lind, J. D., & Antinori, N. (2015). Large-Scale Survey Findings Inform Patients' Experiences in Using Secure Messaging to Engage in Patient-Provider Communication and Self-Care Management: A Quantitative Assessment. *Journal of Medical Internet Research*, *17*(12), e282. https://doi.org/10.2196/jmir.5152

Heeks, R. (2002). *Failure, Success and Improvisation of Information Systems Projects in Developing Countries* (Development Informatics No. Working Paper Series 11). Manchester. Retrieved from http://unpan1.un.org/intradoc/groups/public/documents/NISPAcee/UNPAN015601.pdf

Heeks, R. (2008). ICT4D 2.0: The Next Phase of Applying ICT for International Development. *IEEE Xplore*, *41*(6), 26–33. https://doi.org/10.1109/MC.2008.192

Heeks, R. (2009). *The ICT4D 2.0 Manifesto: Where Next for ICTs and International Development? Development Informatics: Working Paper Series*. Manchester: Institute for Development Policy and Management, University of Manchester. Retrieved from http://www.seed.manchester.ac.uk/medialibrary/IDPM/working_papers/di/di_wp42.pdf

Heid, C., Knobloch, M. J., Schulz, L. T., & Safdar, N. (2016). Use of the Health Belief Model to Study Patient Perceptions of Antimicrobial Stewardship in the Acute Care Setting. *Infection Control & Hospital Epidemiology*, *37*(05), 576–582. https://doi.org/10.1017/ice.2015.342

Helman, C. G. (1985). Communication in primary care: The role of patient and practitioner explanatory models. *Social Science & Medicine*, *20*(9), 923–931. https://doi.org/10.1016/0277-9536(85)90348-X

Helsper, E. J. (2010). Gendered Internet Use Across Generations and Life Stages. *Communication Research*, *37*(3), 352–374. https://doi.org/10.1177/0093650209356439

Henriquez-Camacho, C., Losa, J., Miranda, J. J., & Cheyne, N. E. (2014). Addressing healthy aging populations in developing countries: unlocking the opportunity of eHealth and mHealth. *Emerging Themes in Epidemiology*, *11*(1), 136. https://doi.org/10.1186/s12982-014-0021-4

Hepworth, J. (1997). Evaluation in health outcomes research: linking theories, methodologies and practice in health promotion. *Health Promotion International*, *12*(3), 233–238. https://doi.org/10.1093/heapro/12.3.233

HEU. (2012). *Expanding Social Protection for Health: Towards Universal Coverage: Health Care Financing Strategy 2012-2032*. Dhaka. Retrieved from http://socialprotection.gov.bd/wp-content/uploads/2017/03/HCF-Strategy-Bd-2012-2032.pdf

Hewett, T. T., Baecker, R., Card, S., Carey, T., Gasen, J., Mantei, M., … Verplank, W. (1992). *ACM SIGCHI Curricula for Human-Computer Interaction*. New York, NY, USA: Association for Computing Machinery.

Hilbert, M. (2011a). Digital gender divide or technologically empowered women in developing countries? A typical case of lies, damned lies, and statistics. *Women's Studies International Forum*, *34*(6), 479–489. https://doi.org/http://dx.doi.org/10.1016/j.wsif.2011.07.001

Hilbert, M. (2011b). The End Justifies the Definition: The Manifold Outlooks on the Digital Divide

and Their Practical Usefulness for Policy-making. *Telecommunications Policy*, *35*(8), 715–736.

Hillemeier, M. M., Lynch, J., Harper, S., & Casper, M. (2003). Measuring contextual characteristics for community health. *Health Services Research*, *38*(6 Pt 2), 1645–1717. https://doi.org/10.1111/J.1475-6773.2003.00198.X

Ho, M. R., Smyth, T. N., Kam, M., & Dearden, A. (2009). Human-Computer Interaction for Development: The Past, Present, and Future. *Information Technologies & International Development*, *5*(4), 1. Retrieved from http://web.a.ebscohost.com.ezproxy.sussex.ac.uk/ehost/detail/detail?vid=0&sid=620453bb-a100-43d3-96a9-4ef47cbd7bd6%40sessionmgr4006&bdata=JnNpdGU9ZWhvc3QtbGl2ZQ%3D%3D#AN=48461484&db=buh

Huda, T., Khan, J. A. M., Ahsan, K. Z., Jamil, K., & Arifeen, S. El. (2014). Monitoring and Evaluating Progress Towards Universal Health Coverage in Bangladesh. *PLOS Medicine*, *11*(9), e1001722. https://doi.org/10.1371/journal.pmed.1001722

Ilavarasan, P. V. (2013). Community work and limited online activism among India youth. *International Communication Gazette*, *75*(3), 284–299. https://doi.org/10.1177/1748048512472945

Iqbal, M., Hanifi, S. M. A., & Wahed, T. (2009). Characteristics of Village Doctors. In A. Bhuiya (Ed.), *Health for the Rural Masses: Insights from Chakaria*. Dhaka: International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR,B).

Islam, M. S., & Grönlund, Å. (2011). Bangladesh calling: farmers' technology use practices as a driver for development. *Information Technology for Development*, *17*(2), 95–111. https://doi.org/10.1080/02681102.2010.526093

Islam, S. M. S., Lechner, A., Ferrari, U., Seissler, J., Holle, R., & Niessen, L. W. (2015). Mobile phone use and willingness to pay for SMS for diabetes in Bangladesh. *Journal of Public Health*, 1–7. https://doi.org/10.1093/pubmed/fdv009

ITU. (2014). *Harnessing Mobile Technology to Build an Inclusive Information Society*. (T. D. B. (BDT), Ed.), *M-Powering Development Initiative*. Geneva: International Telecommunication Union (ITU).

ITU. (2016a). *How can we close the digital gender gap?* Geneva. Retrieved from www.LStelcom.com

ITU. (2016b). ICT Facts and Figures – The world in 2015. Retrieved from http://www.itu.int/en/ITU-D/Statistics/Pages/facts/default.aspx

ITU. (2017). *ICT Facts and Figures*. Geneva. Retrieved from https://www.itu.int/en/itu-D/Statistics/Documents/facts/ICTFactsFigures2017.pdf

ITU. (2018). ICT Statistics Home Page. Retrieved from https://www.itu.int/en/ITU-D/Statistics/Pages/default.aspx

ITU. (2019). Statistics. Retrieved January 31, 2019, from https://www.itu.int/en/ITU-D/Statistics/Pages/stat/default.aspx

Iyawa, Gloria E., Herselman, M., & Botha, A. (2017). A scoping review of digital health innovation ecosystems in developed and developing countries. In *2017 IST-Africa Week Conference, IST-Africa 2017*. Institute of Electrical and Electronics Engineers Inc. https://doi.org/10.23919/ISTAFRICA.2017.8102325

Iyawa, Gloria Ejehiohen, Herselman, M., & Botha, A. (2016). Digital Health Innovation Ecosystems: From Systematic Literature Review to Conceptual Framework. In *Procedia Computer Science* (Vol. 100, pp. 244–252). Elsevier B.V. https://doi.org/10.1016/j.procs.2016.09.149

Jacobs, B., Ir, P., Bigdeli, M., Annear, P. L., & Van Damme, W. (2012). Addressing access barriers to health services: an analytical framework for selecting appropriate interventions in low-income Asian countries. *Health Policy and Planning*, *27*(4), 288–300. https://doi.org/10.1093/heapol/czr038

Jimenez-Pernett, J., de Labry-Lima, A., Bermudez-Tamayo, C., Garcia-Gutierrez, J., & del Carmen, S.-S. M. (2010). Use of the internet as a source of health information by Spanish adolescents. *BMC Medical Informatics and Decision Making*, *10*(1), 6. Retrieved from http://www.biomedcentral.com/1472-6947/10/6

Jo, Y., Labrique, A. B., Lefevre, A. E., Mehl, G., & Pfaff, T. (2014). Using the Lives Saved Tool (LiST) to Model mHealth Impact on Neonatal Survival in Resource-Limited Settings. *PLoS ONE*, *9*(7), 102224. https://doi.org/10.1371/journal.pone.0102224

Johnson, O. A., Fraser, H. S. F., Wyatt, J. C., & Walley, J. D. (2014). Electronic health records in the UK and USA. *The Lancet*, *384*(9947), 954. https://doi.org/10.1016/S0140-6736(14)61626-3

Johnston, D. S. (2017). Digital maturity: are we ready to use technology in the NHS? *Future Healthcare Journal*, *4*(3), 189–192. https://doi.org/10.7861/futurehosp.4-3-189

Johnstone, J. (2007). Technology as empowerment: a capability approach to computer ethics. *Ethics and Inf. Technol.*, *9*(1), 73–87. https://doi.org/10.1007/s10676-006-9127-x

Jones, M., Robinson, S., Pearson, J., Joshi, M., Raju, D., Mbogo, C. C., … Harper, R. (2017). Beyond "yesterday's tomorrow": future-focused mobile interaction design by and for emergent users. *Personal and Ubiquitous Computing*, *21*(1), 157–171. https://doi.org/10.1007/s00779-016-0982-0

Kaarakainen, M.-T., Kivinen, A., & Kaarakainen, S.-S. (2017). Differences between the genders in ICT skills for Finnish upper comprehensive school students: Does gender matter? *International Journal of Media, Technology and Lifelong Learning*, *13*(2). Retrieved from https://journals.hioa.no/index.php/seminar/article/view/2304/2132

Kaicker, J., Debono, V. B., Dang, W., Buckley, N., & Thabane, L. (2010). Assessment of the quality and variability of health information on chronic pain websites using the DISCERN instrument. *BMC Medicine*, *8*(1), 1–8. https://doi.org/10.1186/1741-7015-8-59

Kamal Quadir. (2015). The Story of bKash | The Daily Star. Retrieved from https://www.thedailystar.net/the-story-of-bkash-21235

Karch, A., Nicholson-Crotty, S. C., Woods, N. D., & Bowman, A. O. (2016). Policy Diffusion and the Pro-innovation Bias. *Political Research Quarterly*, *69*(1), 83–95. https://doi.org/10.1177/1065912915622289

Kayrouz, R., Dear, B. F., Karin, E., & Titov, N. (2016). Facebook as an effective recruitment strategy for mental health research of hard to reach populations. *Internet Interventions*, *4*, 1–10. https://doi.org/10.1016/J.INVENT.2016.01.001

Kayser, L., Kushniruk, A., Osborne, R. H., Norgaard, O., & Turner, P. (2015). Enhancing the Effectiveness of Consumer-Focused Health Information Technology Systems Through eHealth Literacy: A Framework for Understanding Users' Needs. *JMIR Human Factors*, *2*(1), e9. https://doi.org/10.2196/humanfactors.3696

Khalil, M. A., Dongier, P., D'Costa, V., Zhen-Wei Qiang, C., Smith, P. L., Sudan, R., … Wellenius, B. (2009). *2009 information and communications for development : extending reach and increasing impact*. Washington, D.C. Retrieved from http://documents.worldbank.org/curated/en/645821468337815208/pdf/487910PUB0EPI1101Official0Use0Only1.pdf

Khalil, M., & Kenny, C. (2008). The Next Decade of ICT Development: Access, Applications, and the

Forces of Convergence. *Information Technologies and International Development*, *4*(3), 1–6.

Khan, N. U. Z., Rasheed, S., Sharmin, T., Ahmed, T., Mahmood, S. S., Khatun, F., … Bhuiya, A. (2015). Experience of using mHealth to link village doctors with physicians: lessons from Chakaria, Bangladesh. *BMC Medical Informatics and Decision Making*, *15*. https://doi.org/10.1186/s12911-015-0188-9

Khatun, F, Heywood, A. E., Ray, P. K., Hanifi, S. M., Bhuiya, A., & Liaw, S. T. (2015). Determinants of readiness to adopt mHealth in a rural community of Bangladesh. *Int J Med Inform*, *84*(10), 847–856. https://doi.org/10.1016/j.ijmedinf.2015.06.008

Khatun, Fatema, Hanifi, S. M. A., Iqbal, M., Rasheed, S., Rahman, M. S., Ahmed, T., … Bhuiya, A. (2014). Prospects of mHealth Services in Bangladesh: Recent Evidence from Chakaria. *PLoS ONE*, *9*(11), e111413. Retrieved from http://dx.doi.org/10.1371%2Fjournal.pone.0111413

Khatun, Fatema, Heywood, A. E., Hanifi, S. M. A., Rahman, M. S., Ray, P. K., Liaw, S.-T., & Bhuiya, A. (2017). Gender differentials in readiness and use of mHealth services in a rural area of Bangladesh. *BMC Health Services Research*, *17*(1), 573. https://doi.org/10.1186/s12913-017-2523-6

Kiwanuka, S. N., Ekirapa, E. K., Peterson, S., Okui, O., Rahman, M. H., Peters, D., & Pariyo, G. W. (2008). Access to and utilisation of health services for the poor in Uganda: a systematic review of available evidence. *Transactions of the Royal Society of Tropical Medicine and Hygiene*, *102*(11), 1067–1074. https://doi.org/10.1016/j.trstmh.2008.04.023

Kleine, D. (2009). ICT4What? - using the Choice Framework to operationalise the capability approach to development. In *Information and Communication Technologies and Development (ICTD), 2009 International Conference on* (pp. 108–117). https://doi.org/10.1109/ICTD.2009.5426717

Kleine, Dorothea. (2013). *Technologies of choice? : ICTs, development, and the capabilities approach*. Cambridge, London: MIT Press. Retrieved from https://books.google.co.uk/books/about/Technologies_of_Choice.html?id=uhV09JP2H5YC&redir_esc=y

Kline, R. R. (2015). Technological Determinism. *International Encyclopedia of the Social & Behavioral Sciences*, 109–112. https://doi.org/10.1016/B978-0-08-097086-8.85034-5

Krathwohl, D. R. (2002). A Revision of Bloom's Taxonomy: An Overview. *Theory Into Practice*, *41*(4), 212. Retrieved from http://search.ebscohost.com/login.aspx?direct=true&db=buh&AN=8550701&site=ehost-live

Krippendorff, K. (2004). *Content Analysis: An Introduction to Its Methodology*. (M. H. Seawell, Ed.) (Second). California: Sage Publications, Inc. Retrieved from https://books.google.co.uk/books?id=q657o3M3C8cC

Kurtzman, E. T., & Greene, J. (2016). Effective presentation of health care performance information for consumer decision making: A systematic review. *Patient Education and Counseling*, *99*(1), 36–43. https://doi.org/10.1016/J.PEC.2015.07.030

Larry Elliott. (2019, January 21). World's 26 richest people own as much as poorest 50%, says Oxfam. Retrieved from https://www.theguardian.com/business/2019/jan/21/world-26-richest-people-own-as-much-as-poorest-50-per-cent-oxfam-report

Lawson, C. (2010). Technology and the Extension of Human Capabilities. *Journal for the Theory of Social Behaviour*, *40*(2), 207–223. https://doi.org/10.1111/j.1468-5914.2009.00428.x

Lee, K., Hoti, K., Hughes, J. D., & Emmerton, L. M. (2015). Consumer Use of "Dr Google": A Survey on Health Information-Seeking Behaviors and Navigational Needs. *Journal of Medical Internet Research*, *17*(12), e288. https://doi.org/10.2196/jmir.4345

Lewis, T., Synowiec, C., Lagomarsinoa, G., & Schweitzera, J. (2012). E-Health in Low- and Middle-Income Countries: Findings from the Center for Health Market Innovations. *Bulletin of the World Health Organization*, *90*(5), 332–340. https://doi.org/10.2471/BLT.11.099820

Lim, J. B. Y. (2013). Video blogging and youth activism in Malaysia. *International Communication Gazette*, *75*(3), 300–321. https://doi.org/10.1177/1748048512472947

Lucas, H. (2015). New technology and illness self-management: Potential relevance for resource-poor populations in Asia. *Social Science & Medicine*, *145*, 145–153. https://doi.org/10.1016/J.SOCSCIMED.2014.11.008

Lukasik, S. (2011). Why the Arpanet Was Built. *IEEE Annals of the History of Computing*, *33*(3), 4–21. https://doi.org/10.1109/MAHC.2010.11

Mahmood, K. (2016). Do People Overestimate Their Information Literacy Skills? A Systematic Review of Empirical Evidence on the Dunning-Kruger Effect. *Comminfolit*, *10*(2), 199. https://doi.org/10.15760/comminfolit.2016.10.2.24

Mahmood, S. S., Iqbal, M., Hanifi, S. M. A., Wahed, T., & Bhuiya, A. (2010). Are "Village Doctors" in Bangladesh a Curse or a Blessing? *BMC International Health and Human Rights*, *10*(18). Retrieved from http://www.biomedcentral.com/1472-698X/10/18

Mahmoodi, N., Bekker, H. L., King, N. V., Hughes, J., Jones, G. L., Velikova, G., … Stark, D. (2018). Are publicly available internet resources enabling women to make informed fertility preservation decisions before starting cancer treatment: An environmental scan? 11 Medical and Health Sciences 1117 Public Health and Health Services. *BMC Medical Informatics and Decision Making*, *18*(1). https://doi.org/10.1186/s12911-018-0698-3

Makri, A. (2019). *Bridging the digital divide in health care. The Lancet Global Health* (Vol. 1). https://doi.org/10.1016/S2589-7500(19)30111-6

MAMA. (2015). The power of health in every mama's hand. Retrieved from http://www.mobilemamaalliance.org/

Mannan, M. A. (2013). *Access to Public Health Facilities in Bangladesh: A Study on Facility Utilisation and Burden of Treatment. Bangladesh Development Studies* (Vol. XXXVI). Retrieved from http://bids.org.bd/uploads/publication/BDS/36/36-4/2_Mannan.pdf

Marley, S., Bekker, H. L., & Bewick, B. M. (2016). Responding to personalised social norms feedback from a web-based alcohol reduction intervention for students: Analysis of think-aloud verbal protocols. *Psychology and Health*, *31*(9), 1007–1024. https://doi.org/10.1080/08870446.2016.1161192

Marmot, M. (2006). Health in an unequal world. *The Lancet*, *368*(9552), 2081–2094. https://doi.org/http://dx.doi.org/10.1016/S0140-6736(06)69746-8

Marmot, M. (2007). Achieving Health Equity: From Root Causes to Fair Outcomes. *The Lancet*, *370*(9593), 1153–1163.

May, J. (2015). Human-Computer Interfaces. *International Encyclopedia of the Social & Behavioral Sciences (Second Edition)(Second Edition)*, 400–404. https://doi.org/10.1016/B978-0-08-097086-8.95072-4

Mayring, P. (2000). Qualitative Content Analysis. *Forum Qualitative Sozialforschung / Forum: Qualitative Social Research*, *1*(2). Retrieved from http://www.qualitative-research.net/index.php/fqs/article/view/1089/2385#gcit

McLaurin-Jones, T. L., Lashley, M.-B., & Marshall, V. J. (2017). Using Qualitative Methods to Understand Perceptions of Risk and Condom Use in African American College Women:

Implications for Sexual Health Promotion. *Health Education & Behavior*, *44*(5), 805–814. https://doi.org/10.1177/1090198117728759

Mechael, P., Batavia, H., Kaonga, N., Searle, S., Kwan, A., Goldberger, A., … The Earth Institute, C. U. and mHealth A. (2010). *Barriers and Gaps Affecting mHealth in Low and Middle Income Countries: Policy White Paper*. The Earth Institute, Columbia University and mHealth Alliance.

Mehl, G., & Labrique, A. (2014). Prioritizing integrated mHealth strategies for universal health coverage. *Science*, *345*(6202), 1284–1287. https://doi.org/10.1126/science.1258926

Mehmood, Y., Barbieri, N., & Bonchi, F. (2016). Modeling adoptions and the stages of the diffusion of innovations. *Knowledge and Information Systems*, *48*(1), 1–27. https://doi.org/10.1007/s10115-015-0889-5

Merriënboer, J. J. G., Clark, R. E., & Croock, M. B. M. (2002). Blueprints for complex learning: The 4C/ID-model. *Educational Technology Research and Development*, *50*(2), 39–61. https://doi.org/10.1007/bf02504993

Miletzki, J., & Broten, N. (2017). *Development as Freedom*. Macat Library. Retrieved from https://books.google.co.uk/books?id=OkorDwAAQBAJ

Militello, L. G., & Hutton, R. J. (1998). Applied cognitive task analysis (ACTA): a practitioner's toolkit for understanding cognitive task demands. *Ergonomics*, *41*(11), 1618–1641. https://doi.org/10.1080/001401398186108

Minges, M. (2016). *Exploring the Relationship Between Broadband and Economic Growth*. Washington, D.C. Retrieved from http://documents.worldbank.org/curated/en/178701467988875888/pdf/102955-WP-Box394845B-PUBLIC-WDR16-BP-Exploring-the-Relationship-between-Broadband-and-Economic-Growth-Minges.pdf

Ministry of Science. (2013). *Korean Internet White Paper. ICT and Future Planning*. Seul: Korea Internet and Security Agency Seoul Korea.

Miriam J.Flanagin, A. J., & Metzger. (2014). *The Oxford Handbook of Political Communication*. (K. Kenski & K. H. Jamieson, Eds.) (Vol. 1). Oxford University Press. https://doi.org/10.1093/oxfordhb/9780199793471.001.0001

Mitsutake, S., Shibata, A., Ishii, K., Okazaki, K., & Oka, K. (2011). Developing Japanese version of the eHealth Literacy Scale (eHEALS). *Nihon Koshu Eisei Zasshi*, *58*(5), 361–371.

MoHFW. (2016). Welcome to Community Based Health Care. Retrieved June 13, 2018, from http://www.communityclinic.gov.bd/

Molla, A. A., & Chi, C. (2017). Who pays for healthcare in Bangladesh? An analysis of progressivity in health systems financing. *International Journal for Equity in Health*, *16*(1), 167. https://doi.org/10.1186/s12939-017-0654-3

Mooney, G. (2000). Vertical Equity in Health Care Resource Allocation. *Health Care Analysis*, *8*(3), 203–215. https://doi.org/10.1023/A:1009439917796

MoSICT. (2009). *National ICT Policy - 2009*. Ministry of Science and Information & Communication Technology, Government of the People's Republic of Bangladesh. Retrieved from http://sufi-faruq.com/sites/default/files/policy/ict/ict_policy_2009_en.pdf

mPower. (2018). mTika wins 'best innovation – healthcare' award at the Bangladesh innovation awards 2018. Retrieved February 9, 2019, from https://www.mpower-social.com/mtika-bia.php

Nambiar, S. (2013). Capabilities, conversion factors and institutions. *Progress in Development Studies*, *13*(3),

221–230. https://doi.org/10.1177/1464993413486547

NHS England. (2017). *Next steps on the NHS Five Year Forward View*. London. Retrieved from https://www.england.nhs.uk/five-year-forward-view/next-steps-on-the-nhs-five-year-forward-view/executive-summary/

NIPORT, MEASURE Evaluation, & Icddrb. (2012). *Bangladesh Maternal Mortality and Health Care Survey 2010*. Dhaka.

NIPORT, MEASURE Evaluation, & Icddrb. (2013). *Bangladesh Urban Health Survey 2013: Preliminary Results*. Dhaka: National Institute of Population Research and Training (NIPORT), MEASURE Evaluation, UNC-Chapel Hill, USA and International Centre for DIarrhoeal Disease Research, Bangladesh (icddr,b).

NIPORT, Mitra and Associates, & ICF International. (2013). *Bangladesh Demographic and Health Survey 2011*. Dhaka, Bangladesh and Calverton, Maryland, USA: NIPORT, Mitra and Associates, and ICF International.

NIPORT, Mitra and Associates, & ICF International. (2016). *Bangladesh Demographic and Health Survey 2014*. Dhaka: NIPORT, Mitra and Associates and ICF International.

Norman, C. (2011). eHealth Literacy 2.0: Problems and Opportunities With an Evolving Concept. *Journal of Medical Internet Research*, *13*(4), e125. https://doi.org/10.2196/jmir.2035

Norman, C. D., & Skinner, H. A. (2006). eHEALS: The eHealth Literacy Scale. *Journal of Medical Internet Research*, *8*(4), e27. https://doi.org/10.2196/jmir.8.4.e27

Nussbaum, M. C. (2000). *Women and Human Development: The Capabilities Approach*. New York: Cambridge University Press.

Nutbeam, D. (2009). Defining and measuring health literacy: what can we learn from literacy studies? *International Journal of Public Health*, *54*(5), 303–305. https://doi.org/10.1007/s00038-009-0050-x

OECD. (2001). *Understanding the Digital Divide*. Paris: Organisation for Economic Co-Operation and Development (OECD).

Office for National Statistics. (2019). Healthcare expenditure, UK Health Accounts. Retrieved January 1, 2020, from https://www.ons.gov.uk/peoplepopulationandcommunity/healthandsocialcare/healthcaresystem/bulletins/ukhealthaccounts/2017

Oliver, A., & Mossialos, E. (2004). Equity of access to health care: outlining the foundations for action. *Journal of Epidemiology and Community Health*, *58*(8), 655–658. https://doi.org/10.1136/jech.2003.017731

Ono, H., & Zavodny, M. (2003). Gender and the Internet. *Social Science Quarterly*, *84*(1), 111–121. https://doi.org/10.1111/1540-6237.t01-1-8401007

Ono, H., & Zavodny, M. (2007). Digital inequality: A five country comparison using microdata. *Social Science Research*, *36*(3), 1135–1155. https://doi.org/http://dx.doi.org/10.1016/j.ssresearch.2006.09.001

Oosterlaken, I, & van den Hoven, J. (2012). *The Capability Approach, Technology and Design*. Springer Netherlands. Retrieved from https://books.google.co.uk/books?id=X_lSb4NR95IC

Oosterlaken, Ilse. (2011). Inserting Technology in the Relational Ontology of Sen's Capability Approach. *Journal of Human Development and Capabilities*, *12*(3), 425–432. https://doi.org/10.1080/19452829.2011.576661

Oxfam GB. (n.d.). Inequality and poverty. Retrieved January 21, 2019, from https://www.oxfam.org.uk/get-involved/campaign-with-us/inequality-and-poverty

Paina, L., Wilkinson, A., Tetui, M., Ekirapa-Kiracho, E., Barman, D., Ahmed, T., … Bennett, S. (2017). Using Theories of Change to inform implementation of health systems research and innovation: experiences of Future Health Systems consortium partners in Bangladesh, India and Uganda. *Health Research Policy and Systems*, *15*(Suppl 2). https://doi.org/10.1186/s12961-017-0272-y

Patton, M. Q. (2001). *Qualitative Research & Evaluation Methods*. SAGE Publications. Retrieved from https://books.google.co.uk/books?id=vNWlBAAAQBAJ

Pearson, J., Robinson, S., Reitmaier, T., Jones, M., & Joshi, A. (2019). Diversifying Future-Making Through Itinerative Design. *ACM Transactions on Computer-Human Interaction*, *26*(5), 1–21. https://doi.org/10.1145/3341727

Pearson, J., Robinson, S., Reitmaier, T., Jones, M., Joshi, A., Parab, C., … Jenson, S. (2017). Exploring the use of the Physical Web with Resource-Constrained Communities. In *Proceedings of the 2017 CHI Conference Extended Abstracts on Human Factors in Computing Systems - CHI EA '17* (pp. 1117–1125). New York, New York, USA: ACM Press. https://doi.org/10.1145/3027063.3053349

Pencheon, D. (2015). Making health care more sustainable: the case of the English NHS. *Public Health*, *129*(10), 1335–1343. https://doi.org/10.1016/j.puhe.2015.08.010

Perelman, J., Fernandes, A., & Mateus, C. (2012). Gender disparities in health and healthcare: results from the Portuguese National Health Interview Survey. *Cadernos de Saúde Pública*, *28*(12), 2339–2348. https://doi.org/10.1590/S0102-311X2012001400012

Peters, D. H., Garg, A., Bloom, G., Walker, D. G., Brieger, W. R., & Hafizur Rahman, M. (2008). Poverty and Access to Health Care in Developing Countries. *Annals of the New York Academy of Sciences*, *1136*(1), 161–171. https://doi.org/10.1196/annals.1425.011

PEW Research Centre. (2018). Demographics of Mobile Device Ownership and Adoption in the United States. Retrieved February 1, 2019, from http://www.pewinternet.org/fact-sheet/mobile/

Phua, K. H., Sheikh, K., Tang, S.-L., & Lin, V. (2015). Editorial - Health Systems of Asia: Equity, Governance and Social Impact. In *Social science & medicine (1982)* (Vol. 145).

Plsek, P. E., & Greenhalgh, T. (2001). Complexity science: The challenge of complexity in health care. *Bmj*, *323*(7313), 625–628.

Puente, S. N. (2008). From cyberfeminism to technofeminism: From an essentialist perspective to social cyberfeminism in certain feminist practices in Spain. *Women's Studies International Forum*, *31*(6), 434–440. https://doi.org/http://dx.doi.org/10.1016/j.wsif.2008.09.005

Qizilbash, M., & Clark, D. A. (2005). The Capability Approach and Fuzzy Poverty Measures: An Application to the South African Context. *Social Indicators Research*, *74*(1), 103–139. Retrieved from http://www.jstor.org/stable/27522239

Raftree, L. (2018). ICT opportunities and barriers for youth in developing countries. Retrieved April 26, 2018, from https://www.unicef-irc.org/article/1009-ict-opportunities-and-barriers-for-youth-in-developing-countries.html

Rahman, A., Abdullah, M. N., Haroon, A., & Tooheen, R. B. (2013). ICT impact on socio-economic conditions of rural Bangladesh. *Journal of World Economic Research*, *2*(1), 1–8. https://doi.org/10.11648/j.jwer.20130201.11

Rahman, M. S., Hanifi, S., Khatun, F., Iqbal, M., Rasheed, S., Ahmed, T., … Bhuiya, A. (2017). Knowledge, attitudes and intention regarding mHealth in generation Y: evidence from a

population based cross sectional study in Chakaria, Bangladesh. *BMJ Open*, *7*(11), e016217. https://doi.org/10.1136/bmjopen-2017-016217

Räihä, T., Tossavainen, K., Enkenberg, J., & Turunen, H. (2014). Pupils' views on an ICT-based learning environment in health learning. *Technology, Pedagogy and Education*, *23*(2), 181–197. https://doi.org/10.1080/1475939X.2013.795076

Rajan, R., Raihan, A., Alam, M., Agarwal, S., Ahsan, A., Bashir, R., … Labrique, A. B. (2013). *MAMA 'Aponjon' Formative Research Report*. Baltimore: Johns Hopkins University Global mHealth Initiative.

Rangaswamy, N., & Cutrell, E. (2012). Anthropology, Development, and ICTs: Slums, Youth, and the Mobile Internet in Urban India. *Information, Technologies & International Development*, *9*(2 (ICTD 2012 Special Issue)).

Raul Katz. (2012). *The Impact of Broadband on the Economy: Research to Date and Policy Issues*. Retrieved from https://www.itu.int/ITU-D/treg/broadband/ITU-BB-Reports_Impact-of-Broadband-on-the-Economy.pdf

Rice, R. E. (2017). Intermediality and the Diffusion of Innovations. *Human Communication Research*, *43*(4), 531–544. https://doi.org/10.1111/hcre.12119

Rieker, P. P., & Bird, C. E. (2005). Rethinking Gender Differences in Health: Why We Need to Integrate Social and Biological Perspectives. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, *60*(Special Issue 2), S40–S47. https://doi.org/10.1093/geronb/60.Special_Issue_2.S40

Roberts, T. (2015). *Critical-Agency in ICT4D: a case study of Zambian women's use of participatory video technology to challenge gender inequality*. Royal Holloway, University of London.

Robeyns, I. (2000). *An Unworkable Idea Or a Promising Alternative?: Sen's Capability Approach Re-examined*. Kath. Univ. Leuven, Department Economie. Retrieved from https://books.google.co.uk/books?id=WV5IGwAACAAJ

Robeyns, Ingrid. (2003). SEN'S CAPABILITY APPROACH AND GENDER INEQUALITY: SELECTING RELEVANT CAPABILITIES. *Feminist Economics*, *9*(2–3), 61–92. https://doi.org/10.1080/1354570022000078024

Robeyns, Ingrid. (2005). The Capability Approach: a theoretical survey. *Journal of Human Development*, *6*(1), 93–117. https://doi.org/10.1080/146498805200034266

Robinson, L., Cotten, S. R., Ono, H., Quan-Haase, A., Mesch, G., Chen, W., … Stern, M. J. (2015). Digital inequalities and why they matter. *Information, Communication & Society*, *18*(5). https://doi.org/10.1080/1369118X.2015.1012532

Robinson, S., Jones, M., Williamson, J., Murray-Smith, R., Eslambolchilar, P., & Lindborg, M. (2012). Navigation your way: from spontaneous independent exploration to dynamic social journeys. *Personal and Ubiquitous Computing*, *16*(8), 973–985. https://doi.org/10.1007/s00779-011-0457-2

Robinson, S., Pearson, J., Holton, M. D., Ahire, S., & Jones, M. (2019). Sustainabot – Exploring the use of everyday foodstuffs as output and input for and with emergent users. In *Conference on Human Factors in Computing Systems - Proceedings*. Association for Computing Machinery. https://doi.org/10.1145/3290605.3300456

Robinson, S., Pearson, J., Jones, M., Joshi, A., & Ahire, S. (2017). Better together: disaggregating mobile services for emergent users. In *Proceedings of the 19th International Conference on Human-Computer Interaction with Mobile Devices and Services - MobileHCI '17* (pp. 1–13). New York, New York, USA: ACM Press. https://doi.org/10.1145/3098279.3098534

Robinson, S., Pearson, J., Reitmaier, T., Ahire, S., & Jones, M. (2018). Make Yourself at Phone: Reimagining Mobile Interaction Architectures With Emergent Users. In *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems - CHI '18* (pp. 1–12). New York, New York, USA: ACM Press. https://doi.org/10.1145/3173574.3173981

Roemer, J. E. (1998). *Theories of Distributive Justice*. Massachusetts: Harvard University Press.

Rogers, E. M. (2003). *Diffusion of Innovations, 5th Edition*. Free Press. Retrieved from https://books.google.co.uk/books?id=9U1K5LjUOwEC

Rogers, M. (2018). *Bangladesh: Mobile industry driving growth and enabling digital inclusion | Mobile for Development*. London. Retrieved from https://www.gsma.com/mobilefordevelopment/programme/mobile-for-development/bangladesh-mobile-industry-driving-growth-and-enabling-digital-inclusion/

Rosso, J., Coutrix, C., Jones, M., & Nigay, L. (2018). Simulating an extendable tangible slider for eyes-free one-handed interaction on mobile devices. In *Proceedings of the 2018 International Conference on Advanced Visual Interfaces - AVI '18* (pp. 1–9). New York, New York, USA: ACM Press. https://doi.org/10.1145/3206505.3206510

Salus, P. H., & Cerf, V. G. (1995). *Casting the Net: From ARPANET to Internet and Beyond...* USA: Addison-Wesley Longman Publishing Co., Inc.

Samuel, M., Coombes, J., Miranda, J. J., Melvin, R., Young, E., & Azarmina, P. (2004). Assessing computer skills in Tanzanian medical students: an elective experience. *BMC Public Health*, *4*(1), 37. Retrieved from http://www.biomedcentral.com/1471-2458/4/37

Schaller, S., Marinova-Schmidt, V., Setzer, M., Kondylakis, H., Griebel, L., Sedlmayr, M., … Kolominsky-Rabas, P. L. (2016). Usefulness of a Tailored eHealth Service for Informal Caregivers and Professionals in the Dementia Treatment and Care Setting: The eHealthMonitor Dementia Portal. *JMIR Research Protocols*, *5*(2), e47. https://doi.org/10.2196/resprot.4354

Scott, J. (2012). *Social Network Analysis*. SAGE Publications. Retrieved from http://books.google.co.uk/books?id=MJoIGBfYDGEC

Sein, M. K., & Harindranath, G. (2004). Conceptualizing the ICT Artifact: Toward Understanding the Role of ICT in National Development. *The Information Society*, *20*(1), 15–24. https://doi.org/10.1080/01972240490269942

Sen, A. K. (1999). Health in development. *Bulletin of the World Health Organization*, *77*(8), 619–662. Retrieved from http://apps.who.int/iris/bitstream/handle/10665/56741/critical.pdf?sequence=1&isAllowed=y

Sen, A. (1992). *Inequality Reexamined*. Clarendon Press. Retrieved from https://books.google.co.uk/books?id=D6_eCtTK6-oC

Sen, A. (1999). *Development as Freedom*. Oxford University Press. Retrieved from https://books.google.co.uk/books?id=NQs75PEa618C

Sen, Amartya. (1985). Well-Being, Agency and Freedom: The Dewey Lectures 1984. *The Journal of Philosophy*, *82*(4), 169–221. https://doi.org/10.2307/2026184

Sen, Amartya. (2005). Human Rights and Capabilities. *Journal of Human Development*, *6*(2), 151–166. https://doi.org/10.1080/14649880500120491

Sen, Amartya. (2015, January 6). Universal healthcare: the affordable dream. *The Guardian*. Retrieved from https://www.theguardian.com/society/2015/jan/06/-sp-universal-healthcare-the-affordable-dream-amartya-sen

Shah, R., & Jaisinghani, P. (2014). Toward a More Inclusive Digital Economy. *Innovations: Technology, Governance, Globalization*, *Special Is*. Retrieved from https://www.mitpressjournals.org/userimages/ContentEditor/1421439266694/INNOVATIONS-DIGITAL-INCLUSION-FOREWORD.pdf

Shankardass, K., Lofters, A., Kirst, M., & Quiñonez, C. (2012). Public awareness of income-related health inequalities in Ontario, Canada. *International Journal for Equity in Health*, *11*(1), 26. https://doi.org/10.1186/1475-9276-11-26

Sharma, M., Yadav, K., Yadav, N., & Ferdinand, K. C. (2017). Zika virus pandemic—analysis of Facebook as a social media health information platform. *American Journal of Infection Control*, *45*(3). https://doi.org/10.1016/j.ajic.2016.08.022

Shih, E., Kraemer, K. L., & Dedrick, J. (2008). IT Diffusion in Developing Countries. *Communications of the ACM*, *51*(2), 43–48. Retrieved from http://10.0.4.121/1314215.1314223

Song, Y., & Bian, Y. (2014). Gender differences in the use of health care in China: cross-sectional analysis. *International Journal for Equity in Health*, *13*, 8. https://doi.org/10.1186/1475-9276-13-8

Sophie Castle-Clarke. (2018). *What will new technology mean for the NHS and its patients?: Four big technological trends*. Retrieved from www.soapbox.co.uk

Soron, T. R., & Chowdhury, C. A. (2016). Facebook, Violence and Safety of Children in Bangladesh. *Journal of Psychiatry*, *19*(3), 368. https://doi.org/10.4172/2378-5756.1000368

Stellefson, M., Alber, J. M., Wang, M. Q., Eddy, J. M., Chaney, B. H., & Chaney, J. D. (2015). Use of Health Information and Communication Technologies to Promote Health and Manage Behavioral Risk Factors Associated With Chronic Disease: Applications in the Field of Health Education. *American Journal of Health Education*, *46*(4), 185–191. https://doi.org/10.1080/19325037.2015.1043064

Stellefson, M., Hanik, B., Chaney, B., Chaney, D., Tennant, B., & Chavarria, E. A. (2011). eHealth Literacy Among College Students: A Systematic Review With Implications for eHealth Education. *Journal of Medical Internet Research*, *13*(4), e102. https://doi.org/10.2196/jmir.1703

Straton, N., Hansen, K., Mukkamala, R. R., Hussain, A., Gronli, T.-M., Langberg, H., & Vatrapu, R. (2016). Big social data analytics for public health: Facebook engagement and performance. In *2016 IEEE 18th International Conference on e-Health Networking, Applications and Services (Healthcom)* (pp. 1–6). IEEE. https://doi.org/10.1109/HealthCom.2016.7749497

Sugden, R. (1993). Welfare, Resources, and Capabilities: A Review [Inequality Reexamined]. *Journal of Economic Literature*, *31*(4), 1947–1962. Retrieved from https://econpapers.repec.org/RePEc:aea:jeclit:v:31:y:1993:i:4:p:1947-62

Sutton, M. (2002). Vertical and horizontal aspects of socio-economic inequity in general practitioner contacts in Scotland. *Health Economics*, *11*(6), 537–549. https://doi.org/10.1002/hec.752

Tennant, B., Stellefson, M., Dodd, V., Chaney, B., Chaney, D., Paige, S., & Alber, J. (2015). eHealth Literacy and Web 2.0 Health Information Seeking Behaviors Among Baby Boomers and Older Adults. *Journal of Medical Internet Research*, *17*(3), e70. https://doi.org/10.2196/jmir.3992

The Economist. (2012). The path through the fields - Bangladesh and development. Retrieved June 4, 2018, from https://www.economist.com/briefing/2012/11/03/the-path-through-the-fields

The Interaction Design Foundation. (2019). What is Human-Computer Interaction (HCI)? | Interaction Design Foundation. Retrieved December 22, 2019, from https://www.interaction-design.org/literature/topics/human-computer-interaction

The Lancet Child & Adolescent Health. (2018). Growing up in a digital world: benefits and risks. *The Lancet Child & Adolescent Health*, *2*(2), 79. https://doi.org/10.1016/S2352-4642(18)30002-6

Thomas, J. J., & Parayil, G. (2008). Bridging the Social and Digital Divides in Andhra Pradesh and Kerala: A Capabilities Approach. *Development and Change*, *39*(3), 409–435. https://doi.org/10.1111/j.1467-7660.2008.00486.x

Tiwari, M. (2008). ICTs and poverty reduction: user perspective study of rural Madhya Pradesh, India. *European Journal of Development Research*, *20*(3), 448–461. https://doi.org/10.1080/09578810802245600

Tran, M. C., Labrique, A. B., Mehra, S., Ali, H., Shaikh, S., Mitra, M., … West Jr, K. (2015). Analyzing the Mobile "Digital Divide": Changing Determinants of Household Phone Ownership Over Time in Rural Bangladesh. *JMIR MHealth and UHealth*, *3*(1), e24. https://doi.org/10.2196/mhealth.3663

Uddin, M. J., Shamsuzzaman, M., Horng, L., Labrique, A., Vasudevan, L., Zeller, K., … Alam, N. (2016). Use of mobile phones for improving vaccination coverage among children living in rural hard-to-reach areas and urban streets of Bangladesh. *Vaccine*, *34*(2), 276–283. https://doi.org/10.1016/j.vaccine.2015.11.024

Ullah, M. S. (2013). ICTs changing youths' political attitudes and behaviors in Bangladesh. *International Communication Gazette*, *75*(3), 271–283. https://doi.org/10.1177/1748048512472859

UNDP. (n.d.). Human Development Index (HDI). Retrieved January 21, 2019, from http://hdr.undp.org/en/content/human-development-index-hdi

UNDP. (2005). *Human Development Report 2005: International Cooperation at a Crossroads. Aid, Trade and Security in an Unequal World*. New York: United Nations Development Programme. Retrieved from http://hdr.undp.org/sites/default/files/reports/266/hdr05_complete.pdf

UNICEF. (2017). *The state of the world's children 2017: children in a digital world*. New York. Retrieved from https://www.unicef.org/publications/files/SOWC_2017_ENG_WEB.pdf

United Nations. (n.d.). Universal Declaration of Human Rights. Retrieved January 10, 2019, from http://www.un.org/en/universal-declaration-human-rights/

Upadhya, C. (2007). *Employment, Exclusion and "Merit" in the Indian IT Industry*. Retrieved from http://www.epw.in/special-articles/employment-exclusion-and-merit-indian-it-industry.html

van der Heide, I., Uiters, E., Jantine Schuit, A., Rademakers, J., & Fransen, M. (2015). Health literacy and informed decision making regarding colorectal cancer screening: a systematic review. *The European Journal of Public Health*, *25*(4), 575–582. https://doi.org/10.1093/eurpub/ckv005

van der Vaart, R., van Deursen, A. J. A. M., Drossaert, C. H. C., Taal, E., van Dijk, J. A. M. G., & van de Laar, M. A. F. J. (2011). Does the eHealth Literacy Scale (eHEALS) Measure What it Intends to Measure? Validation of a Dutch Version of the eHEALS in Two Adult Populations. *Journal of Medical Internet Research*, *13*(4), e86. https://doi.org/10.2196/jmir.1840

van Deursen, Alexander J.A.M., & van Dijk, J. A. G. M. (2015). Internet skill levels increase, but gaps widen: a longitudinal cross-sectional analysis (2010–2013) among the Dutch population. *Information, Communication & Society*, *18*(7), 782–797. https://doi.org/10.1080/1369118X.2014.994544

van Deursen, Alexander J.A.M., van Dijk, J. A. G. M., & ten Klooster, P. M. (2015). Increasing inequalities in what we do online: A longitudinal cross sectional analysis of Internet activities among the Dutch population (2010 to 2013) over gender, age, education, and income. *Telematics and Informatics*, *32*(2), 259–272. https://doi.org/10.1016/J.TELE.2014.09.003

van Deursen, Alexander J A M, & van Dijk, J. A. G. M. (2009). Using the Internet: Skill related problems in users' online behavior. *Interacting with Computers*, *21*(5–6), 393–402. https://doi.org/http://dx.doi.org/10.1016/j.intcom.2009.06.005

van Deursen, Alexander J A M, & van Dijk, J. A. G. M. (2011). Internet Skills Performance Tests: Are People Ready for eHealth? *Journal of Medical Internet Research*, *13*(2), e35. https://doi.org/10.2196/jmir.1581

Vodafone Group. (2015). What is M-Pesa? Retrieved from http://www.vodafone.com/content/index/about/about-us/money_transfer.html

Wagstaff, A. (2002). Poverty and health sector inequalities. *Bulletin of the World Health Organization*, *80*, 97–105. https://doi.org/10.1590/S0042-96862002000200004

Waldman, L., Ahmed, T., Scott, N., Akter, S., Standing, H., & Rasheed, S. (2018). 'We have the internet in our hands': Bangladeshi college students' use of ICTs for health information. *Globalization and Health*, *14*. https://doi.org/10.1186/s12992-018-0349-6

Walton, L. M., & Schbley, B. (2013). Maternal Healthcare in Bangladesh and Gender Equity: A Review Article. *Online Journal of Health Ethics*, *9*(1).

Waring, T. S. (2015). Information management and technology strategy development in the UK's acute hospital sector: a maturity model perspective. *Public Money & Management*, *35*(4), 281–288. https://doi.org/10.1080/09540962.2015.1047271

Waterson, P. (2014). Health information technology and sociotechnical systems: A progress report on recent developments within the UK National Health Service (NHS). *Applied Ergonomics*, *45*(2), 150–161. https://doi.org/10.1016/j.apergo.2013.07.004

Watkins, I., & Xie, B. (2014). eHealth Literacy Interventions for Older Adults: A Systematic Review of the Literature. *Journal of Medical Internet Research*, *16*(11), e225. https://doi.org/10.2196/jmir.3318

Weigel, G., & Waldburger, D. (2004). *ICT4D – Connecting People for a Better World: Lessons, Innovations and Perspectives of Information and Communication Technologies in Development*. Daniele : Swiss Agency for Development and Cooperation (SDC) and the Global Knowledge Partnership (GKP). Retrieved from www.sdc.admin.ch

Weil, A. R. (2018). Diffusion Of Innovation. *Health Affairs*, *37*(2), 175–175. https://doi.org/10.1377/hlthaff.2018.0059

Werts, N., & Hutton-Rogers, L. (2013). Barriers To Achieving E-Health Literacy. *American Journal of Health Sciences*, *4*(3), 112–115. https://doi.org/http://dx.doi.org/10.19030/ajhs.v4i3.8007

WHO. (2003). *The World Health Report 2003: Shaping the Future. The World Health Report*. Geneva: World Health Organization (WHO).

WHO. (2011a). Fact file on health inequities. *WHO*. Retrieved from http://www.who.int/sdhconference/background/news/facts/en/

WHO. (2011b). *mHealth: New horizons for health through mobile technologies: second global survey on eHealth*. Geneva. Retrieved from http://www.who.int/about/

WHO. (2014a). Achieving the health-related MDGs. It takes a workforce! Retrieved June 12, 2018, from http://www.who.int/hrh/workforce_mdgs/en/

WHO. (2014b). *WHO country cooperation strategy Bangladesh 2014-2017*. India: World Health Organization, Country Office for Bangladesh. Retrieved from http://www.searo.who.int/bangladesh/publications/ccs_ban_2014-2017.pdf?ua=1

WHO. (2015a). Accessibility. Retrieved October 24, 2018, from http://www.who.int/gender-equity-rights/understanding/accessibility-definition/en/

WHO. (2015b). *World health statistics 2015*. Luxembourg: World Health Organization.

WHO. (2016a). Constitution of the World Health Organization: Principles. Retrieved January 23, 2019, from https://www.who.int/about/mission/en/

WHO. (2016b). *EPI Fact Sheet*. New Delhi . Retrieved from http://www.searo.who.int/immunization/data/bangladesh.pdf

WHO. (2017a). 10 facts on health inequities and their causes. Retrieved January 23, 2019, from https://www.who.int/features/factfiles/health_inequities/en/

WHO. (2017b). Community clinics in Bangladesh: Bringing health care to the doorstep of rural people. Retrieved February 8, 2019, from http://www.searo.who.int/mediacentre/events/community-clinics-bangladesh-story/en/

WHO. (2017c). *Health financing profile 2017: Bangladesh Context*. Dhaka. Retrieved from http://apps.who.int/iris/bitstream/handle/10665/259640/BAN_HFP.pdf;jsessionid=9218FD80B90998625550E5AA67985091?sequence=1

WHO. (2018a). Life expectancy. Retrieved January 22, 2019, from https://www.who.int/gho/mortality_burden_disease/life_tables/situation_trends/en/

WHO. (2018b). Millennium Development Goals (MDGs). Retrieved June 28, 2018, from http://www.who.int/news-room/fact-sheets/detail/millennium-development-goals-(mdgs)

Williams, B., & Healy, D. (2001). Perceptions of illness causation among new referrals to a community mental health team: "explanatory model" or "exploratory map"? *Social Science & Medicine*, *53*(4), 465–476. https://doi.org/10.1016/S0277-9536(00)00349-X

Wirth, J., Petry, N., Tanumihardjo, S., Rogers, L., McLean, E., Greig, A., … Rohner, F. (2017). Vitamin A Supplementation Programs and Country-Level Evidence of Vitamin A Deficiency. *Nutrients*, *9*(3), 190. https://doi.org/10.3390/nu9030190

World Bank. (2011). *Information and Communications for Development 2009: Extending Reach and Increasing Impact*. World Bank. Retrieved from http://web.worldbank.org/WBSITE/EXTERNAL/TOPICS/EXTINFORMATIONANDCOMMUNICATIONANDTECHNOLOGIES/EXTIC4D/0,,contentMDK:22229759~menuPK:5870649~pagePK:64168445~piPK:64168309~theSitePK:5870636,00.html

World Bank. (2013). Connecting to Work: How ICTs Are Expanding Job Opportunities Worldwide. Retrieved April 26, 2018, from http://www.worldbank.org/en/news/feature/2013/09/10/how-icts-are-expanding-job-opportunities

World Bank. (2014). Fixed (wired) broadband subscriptions (per 100 people). *Data*. Retrieved from http://data.worldbank.org/indicator/IT.NET.BBND.P2

World Bank. (2015). Life expectancy at birth, total (years). World Bank Group. Retrieved from http://data.worldbank.org/indicator/SP.DYN.LE00.IN/countries/BD-8S-XN?display=default

World Bank. (2016). *Digital revolution gains often remain unrealized*. New Delhi. Retrieved from https://search-proquest-com.ezproxy.sussex.ac.uk/docview/1758332342?rfr_id=info%3Axri%2Fsid%3Aprimo

World Bank. (2017). *Bangladesh - Country snapshot*. Washington, D.C. Retrieved from http://documents.worldbank.org/curated/en/375181507886096515/pdf/120416-WP-PUBLIC-CountrySnapshotBangladesh-CompleteFinal.pdf

World Bank. (2018). Population growth (annual %). Retrieved January 22, 2019, from https://data.worldbank.org/indicator/SP.POP.GROW?end=2017&start=1960&view=chart

Wyatt, S. (2008). Technological Determinism Is Dead; Long Live Technological Determinism. In E. J. Hackett, O. Amsterdamska, M. Lynch, & J. Wajcman (Eds.), *The Handbook of Science and Technology Studies* (Third, pp. 173–175). Cambridge, Massachusetts: The MIT Press.

Yang, S.-C., Luo, Y.-F., & Chiang, C.-H. (2017). The Associations Among Individual Factors, eHealth Literacy, and Health-Promoting Lifestyles Among College Students. *Journal of Medical Internet Research*, *19*(1), e15. https://doi.org/10.2196/jmir.5964

Yingqin, Z., & Geoff, W. (2008). Inequality of what? Social exclusion in the e-society as capability deprivation. *Information Technology & People*, *21*(3), 222–243. https://doi.org/10.1108/09593840810896000

Zere, E., Suehiro, Y., Arifeen, A., Moonesinghe, L., Chanda, S., & Kirigia, J. (2013). Equity in reproductive and maternal health services in Bangladesh. *International Journal for Equity in Health*, *12*(1), 90. Retrieved from http://www.equityhealthj.com/content/12/1/90

Zhang, W., & Lallana, E. C. (2013). Youth, ICTs, and Civic Engagement in Asia. *International Communication Gazette*, *75*(3), 249–252. https://doi.org/10.1177/1748048512472852

Zheng, Y. (2009). Different spaces for e-development: What can we learn from the capability approach? *Information Technology for Development*, *15*(2), 66–82. https://doi.org/10.1002/itdj.20115

Zheng, Y., & Stahl, B. C. (2011). Technology, capabilities and critical perspectives: what can critical theory contribute to Sen's capability approach? *Ethics and Inf. Technol.*, *13*(2), 69–80. https://doi.org/10.1007/s10676-011-9264-8

Zhong, Z.-J. (2011). From access to usage: The divide of self-reported digital skills among adolescents. *Computers & Education*, *56*(3), 736–746. https://doi.org/http://dx.doi.org/10.1016/j.compedu.2010.10.016

Zhou, Y., Singh, N., & Kaushik, P. D. (2011). The digital divide in rural South Asia: Survey evidence from Bangladesh, Nepal and Sri Lanka. *IIMB Management Review*, *23*(1), 15–29. https://doi.org/10.1016/J.IIMB.2010.12.002

Zinnbauer, D. (2007). *What can Social Capital and ICT do for Inclusion?* Luxembourg: European Commission, Directorate-General Joint Research Centre, Institute for Prospective Technological Studies.

Annexure 1 | Packages for Students and Young Adults

Provider	Offer	Special features	Price (BDT)	Validity	Reference
GrameenPhone (GP)	Bundle (min.)	20 min Talk time (GP to GP), 5 MB internet, 5 SMS (GP to GP), 5 MMS (GP to GP)	5	2 Days (10pm-8am)	http://www.grameenphone.com/personal/offers/bundle-offers-you
	Bundle (max.)	498 min Talk time (GP to GP and GP to others), 100 MB internet, 100 SMS (GP to GP), 100 MMS (GP to GP)	299	30 days (24 hours)	
Bangla-link	Daily offer (min.)	12 min Talk time (BL to BL & BL to any operator), 12 MB, 12 SMS (BL to BL), 12 MMS (BL to BL)	10	2 Days (24 hours)	http://www.banglalink.com.bd/en/special-offers/pre-paid-current-promotion/bundle-offer/
	Monthly offer (max.)	500 min Talk time, 10 MB, 20 SMS, 5 MMS	300	30 days (24 hours)	
Airtel	Airtel to Airtel bundles	Min. – 20 min Talk time, 10 MB internet, 20 SMS, 5 MMS	5	Recharge day+1 day	http://www.bd.airtel.com/personal/products-services/prepaid/packages-recharge/bundle-offers/airtel-to-airtel-bundles
		Max – 750 min Talk time, 500 MB internet, 800 SMS, no MMS	228	Recharge day+29 day	
	Mixed bundle	15 BDT talk time (airtel to airtel), 15 BDT talk time (airtel to other operator), 15 BDT (on net SMS), 15 BDT (Internet)	15	Recharge day+1 day	
		200 BDT talk time (airtel to airtel), 200 BDT talk time (airtel to another operator), 200 BDT (on net SMS), 200 BDT (Internet)	199	Recharge day+17 day	
Robi	Daily offer	12 min talk time, 12 MB, 12 SMS	10	1 Day (24 hours)	https://www.robi.com.bd/current-offers/shokal-bikal-bundle-offer
	Weekly offer	150 min talk time (any operator), 51 MB, 50 SMS , 50 MMS	100	7 days (24 hours)	
	Monthly offer	500 min talk time (any operator), 200 MB, 200 SMS	300	30 days (24 hours)	
Teletalk	Teletalk 33tk recharge offer	30 paisa/min (any Teletalk no), 60 paisa/min (to any operator), 33 MB, no SMS, no MMS, 10 sec pulse applicable, applicable for prepaid	33	10 days (internet for 1 day)	http://www.telekothon.com/2015/09/teletalk-33tk-recharge-offer.html
	Teletalk 73tk recharge offer	30 paisa/min (any Teletalk no), 60 paisa/min (to any operator), 73 MB, no SMS, no MMS, 10 sec pulse applicable, applicable for prepaid	73	30 days (internet for 3 day)	

Annexure 2 | Cheap Packages for General People

provider	Offer	Special features	Price (BDT)	Validity	Website link
GrameenPhone	Xplore (post-paid)	FnF 9, Super FnF - 0.5 paisa/sec, FnF-GP-GP-1 paisa/sec, FnF-GP-Others-1.5 paisa/sec), GP to GP: 2 Paisa/Second GP to Others: 2 Paisa/Second, Pulse: 1 Sec SMS: 50 Paisa / SMS, NWD calls: BTCL's Peak (8am - 10pm) & Off-peak (10pm - 8am) rate will be applicable for BTCL charge	499 (New connection fee)	--	http://www.grameenphone.com/personal/postpaid/xplore
	Bondhu (prepaid)	FnF18, FnF: 1 Super FnF (5.5 paisa/10 second) & 17 FnF (11.5 paisa/10 second), GP to GP: 27 paisa /10 second GP to Others: 27 paisa /10 second, Pulse: 10 second SMS: 50 paisa / SMS	200 (New connection fee)	--	http://www.grameenphone.com/personal/prepaid/bondhu
Banglalink	Banglalink Desh (prepaid)	FnF 3 to any operator, 10 second pulse, as low as 10paisa/ 10 second to Banglalink FnF number, Banglalink to Banglalink along with these info		--	http://www.banglalink.com.bd/en/packages/pre-paid/pre-paid-packages/banglalink-desh/
		Banglalink to Banglalink	26	24 hours	
		Banglalink FnF	10	10 pm to 8 am	
			11	8 am to 10 pm	
		To another operator	29	24 hours	
		To FnF of another operator	17	24 hours	
	Banglalink play (prepaid)	18 FnF (any operator) with best FnF rates in the market, one special fnf @ 0.5 paisa/sec, SMS to FnF and special FnF number: 29p/SMS and other local SMS 50paisa/SMS, mms to all Banglalink number: 29p/mms, other operators (Robi) 5 taka/mms, special data pack-9 MB @ tk. 3/day, data pack gifting between members of this package.		--	http://www.banglalink.com.bd/en/packages/pre-paid/pre-paid-packages/banglalink-play/
		Banglalink to Banglalink	15 paisa/ 10 sec	12 am to 4 pm	
			25 paisa/ 10 sec	4pm to 12 am	
		Banglalink FnF	0.7 paisa/ 10 sec	12 am to 4 pm	
			1 paisa/ 10 sec	4pm to 12 am	
		Banglalink special FnF	0.5 paisa/ 10 sec	24 hours	
		To another operator	15 paisa/ 10 sec	12 am to 4 pm	
			25 paisa/ 10 sec	4pm to 12 am	
		To FnF of another operator	11 paisa/ 10 sec	24 hours	
Airtel	*Dosti*	5 super FnF, airtel to airtel 0.25 BDT/min and to others FnF 0.60 BDT/min, SMS charges: to super FnF numbers 0.29 BDT/SMS, to any local no. 0.39 BDT/SMS, 10 sec pulse	--	24 hours	http://www.telekothon.com/2013/09/airtel-dosti-prepaid-package.html
	Super *Adda*	FnF # 29, to airtel FnF 0.30tk/min, to any local numbers 0.60tk/min, to any FnF number 0.29 BDT/SMS, to any local numbers 0.49tk/SMS, MMS charge 5tk/mms, GPRS charge 0.015 BDT/KB, 10 sec pulse	--	24 hours	http://www.telekothon.com/2013/04/airtel-super-adda-prepaid-package-new.html
Robi	Robi *Damal Samal* package with 13 super FnF	FnF 13 to any operator, 2 Robi super FnF @ 4.17paisa/10 sec, 11 any operators Super FnF @ 10 paisa/10 sec, 25 paisa/SMS to any local numbers, 50 paisa /MB internet	--	24 hours	http://www.telekothon.com/2013/11/robi-damal-samal-super-fnf-package.html
	Robi Unlimited FnF package	unlimited FnF, Robi @ 1 paisa/sec (5pm-12 am), Robi @ 0.5 paisa/sec (12am-5pm), to others 1 paisa/sec (24 hours)	--	--	http://www.telekothon.com/2015/03/robi-unlimited-fnf-package.html
Teletalk	*Projonmo* 3G (postpaid)	1FnF number (any operator): voice 4.17paisa/10 sec, video 0.25 BDT/min, 20 paisa/SMS, Teletalk to Teletalk -(10 Paisa/Pulse (peak 8am - 12am), 5 Paisa/Pulse (OFF-PEAK (12am - 8am)), Teletalk to others-(16 Paisa/Pulse for 24 hours), Video	--	--	http://www.teletalk.com.bd/packages/packageDetails.jsp?packageID=3015&menuItem=19004

		call 0.60 BDT/min Pulse: 10 sec, SMS: On internet: BDT. 0.35/SMS and Off internet: BDT. 0.45/SMS, 1 BDT MMS, 0.15 BDT/min Mobile TV			
	Gravity 3G (Prepaid)	10FnF number (any operator), 1p/s or Paisa/Pulse (peak 8am - 5pm), 1p/s or 1Paisa/Pulse (OFF-PEAK (5pm - 12am), Pulse: 1 sec, SMS: 10p/SMS, to Teletalk 1p/s, to others 1.5p/s, Teletalk to Teletalk (video call) 0.60tk/min [8am to 5pm], 35p/SMS, 0.01/30 KB, 1 BDT/mms	--	--	http://www.teletalk.com.bd/packages/packageDetails.jsp?packageID=3021&menuItem=7002&menuItem=19010
CityCell[7]	CityCell one (prepaid)	FnF 2, On internet @0.30tk/min, Off internet @ 1.20 BDT/min, pulse 10 sec, SMS: On net 0.04tk/SMS, Off internet 0.50 BDT/SMS, international SMS BDT 2.5	--	24 hours	http://www.telekothon.com/2012/10/CityCell-pre-paid-post-paid-packages.html
	CityCell *Anondo*	FnF 9, @ 0.30 BDT/min (On internet, 4 umbers), @ 0.72 BDT/min (Off internet, 5 numbers) 9am-11p: On internet @ 0.60 BDT/min, Off internet @ 1.08 BDT/min, 11pm-9am: On internet @ 0.30 BDT/min, Off internet @ 0.72tk/min, 10 sec pulse, On internet @ 0.50/SMS, Off internet @ 0.50 BDT/SMS, international SMS at 2.5 BDT.	--	--	http://www.telekothon.com/2012/10/CityCell-pre-paid-post-paid-packages.html

[7] CityCell was the first tele-communication company in Bangladesh and is no longer providing its services.

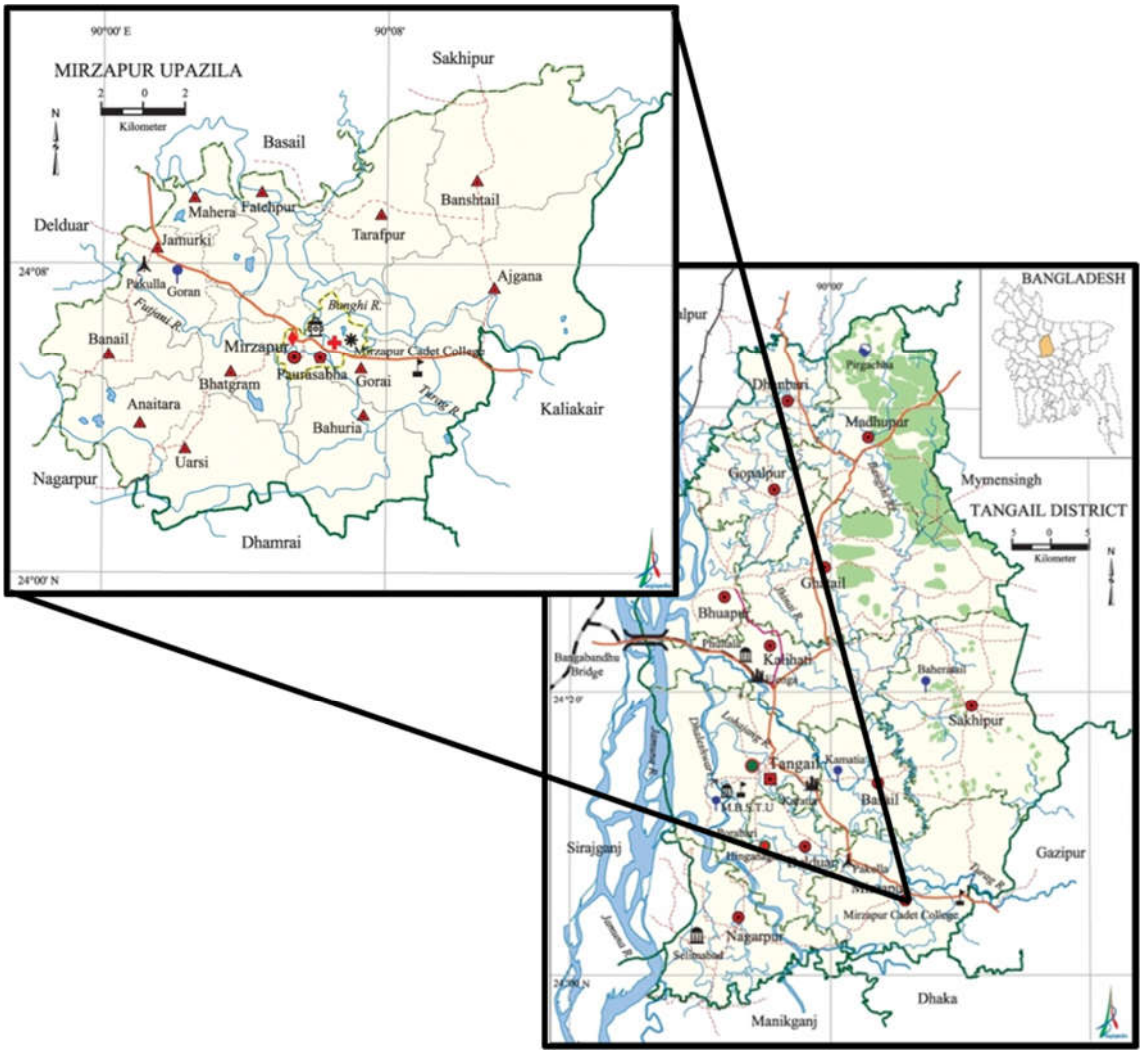
Annexure 3 | Packages for Heavy and Professional Users

Name of the provider	Name of the offer	Special features	Price (BDT)	Validity	Website link
GrameenPhone	Smart plan 499 for Moderate users	400 min (GP to GP, GP to other), 400 SMS (GP-GP), 400 mms (GP-GP), Unlimited internet (FUP 1GB), speed 512kbps,	499	35 days	http://www.telekothon.com/2013/04/grameenphone-brings-3-smartplans-for-you.html
	Smart plan 699 for Moderate users	600 min (GP to GP, GP to other), 600 SMS (GP-GP), 600 mms (GP-GP), Unlimited internet (FUP 2GB), speed 1mbps	699	35 days	http://www.telekothon.com/2013/04/grameenphone-brings-3-smartplans-for-you.html
Banglalink	300 Taka bundle pack	500 min (non FnF any numbers), 200MB, 200 SMS (same operator), 200 MMS same operator), 10 second pulse	300	300 BDT	http://www.telekothon.com/2013/06/banglalink-brings-6-bundle-pack-offers.html
Airtel	1999 Taka bundle	2400 min (to any operator), 10000 SMS (to any operator), 10 GB internet data, international calls: 500 BDT, Airtel to Airtel: 0.30 BDT/min, Airtel to another voice: 0.60 BDT/min, voice call pulse: 1 sec., Airtel to Airtel sms:0.30 BDT/SMS, Airtel to another: 0.30 BDT/SMS, Pay as You Go: 0.0002 BDT/kilobyte	1999	30 days	http://www.telekothon.com/2014/12/airtel-postpaid-bundle-plans.html
Robi	Post-paid bundle offer	1000 min (to any operator) with 4GB internet volume	999	1 month (24 hours)	https://www.robi.com.bd/packages/postpaid/postpaid-bundle-offers
Teletalk	Gravity (3G) (post-paid)	10 FnF number (any operator), 1p/s or Paisa/Pulse (peak 8 am – 5 pm), 1p/s or 1 Paisa/Pulse (Off peak (5 pm – 12 am), Pulse: 1 sec, SMS : 10p/SMS, to Teletalk 1p/s, to others 1.5p/s, Teletalk to Teletalk (video call) 0.60tk/min (8 am to 5 pm), 35p/SMS, 0.01/30 KB, 1 BDT/mms	700 (non-refundable)	--	http://www.teletalk.com.bd/packages/packageDetails.jsp?packageID=3021&menuItem=7002&menuItem=19010
CityCell	CityCell zoom ultra-reactivation offer with 300 Taka bonus on recharge	50 BDT instant bonus (5 days validity), 250 BDT is applicable for first 300tk recharge only & will be given in following 5 months in 5 equal instalments if logs in to any monthly Ultra plan (275tk or above) each month, offer may not valid with any other promotional offer, offer not applicable if customer changes the voice tariff plan	300	30 days	http://www.telekothon.com/2014/08/CityCell-zoom-ultra-reactivation-offer-with-300-taka-bonus-on-recharge.html

Annexure 4 | BKMI List of eHealth and mHealth Initiatives in Bangladesh

Public	DGHS	Health Service through Mobile Phone
		Telemedicine Service
		Telemedicine Service in Community Clinics
		Telemedicine Service in Union Information and Service Centers
		Complaints-Suggestions through SMS
		SMS Advice for safe pregnancy
		Open MRS (Medical Record System)
		Attendance Monitoring System for DGHS staff
		Online Population Health Registry
		HR Database
		Annual Development Program (ADP) progress monitoring system
		GIS in Health
		Schedule Management Software
		Bulk SMS
		Digital Training Facility
		Internet Connectivity in Health System
		Hospital automation
	DGFP	ICT4RH (with UNFPA)
		Provide laptop computers to the FP infrastructure
NGO	MSH/SIAPS (with MoHFW)	UIMS v 2.5
		WIMS v2
		SCIP
		SCMP
		DGDA Web page
		e-TBM
		PharmaDex
	BRAC	m-Health for improving MNCH
	SMC	Marketing Innovation for Health (MIH)
	CRP	Telemedicine Link Service
	DNet	Aponjon
		Dear Infolady
University	Johns Hopkins Bloomberg School of Public Health	m-Care
		m-Tikka
		m-JiVita Basic
		m-JiVita+
	JHU·CCP	BKMI eHealth pilot (with DGHS and DGFP)
Private	eHealth Solutions	eHealth products and services business
	mPower Social Enterprises Ltd	Amader Daktar
		Remote Telemedicine Services in Rural Clinics
		Mobile Health Solutions for Breast Cancer Case-Finding, Referral and Navigation in Rural Bangladesh
		Empowering Micro-Health Insuring Program through Mobile Telemedicine
		MOVE-IT

Annexure 5 | Maps and Location of Mirzapur (Research Site)



Annexure 6 | Guideline to Understand the Scopes and Challenges of eHealth Literacy Among the Young and Educated Adults of Mirzapur

Capabilities
1. Knowledge about sexual and reproductive health. Puberty and related bodily changes, family planning needs and methods, STD including HIV, Menstrual hygiene (in case of female respondents), prevention and care seeking attitude regarding sexual and reproductive health, understanding of medical terms related to sexual and reproductive health i.e. syphilis, gonorrhoea, MR etc. 2. Ability to interact with information. Can you read this article? Can you understand and remember what is in the article? (an article about sexual and reproductive health of young people in Bangladesh) What is the weather like today? (present the current weather report on the area from http://www.bbc.co.uk/weather/) (this will indicate respondent's capacity to interpret numeric data) What do think of health information on YouTube? Which one do you prefer, an informational website or a video? How do you decide what information to believe? 3. Ability to engage with technology. Use the data from participant's task performance.
Access to technologies
1. Access to technologies that work. Ask about the individual and household ownership of mobile phones, computers and SIM cards. Challenges in accessing technologies. 2. Access to technologies that suit individual needs. Are you happy with whatever technology that you have access to? Are being able to perform everything that you need to access information? Do you know about various health information portals? Do you use them?
Experience using technologies
1. Feeling about the tasks given: how did you find the exercise of finding information online? What would you do if this was a real problem for you? Which exercise (source) did you find most/least helpful and why? What unanswered questions do you still have about the information you found? 2. Feel that using technologies is beneficial What kinds of health information have you looked up on your mobile phone or the internet? Why did you use this way to find out the information? How do you feel about using technologies for accessing health information? Give an example of what is more or beneficial about using technologies compared to regular ways. In your opinion what factors influence access to accurate and trustworthy health information through electronic sources? Do you find electronic evidence is organised for easy understanding? Which sites did you find easiest to understand and why? 3. Feel in control and secure when using technologies. What do you think about the safety and security of using electronic platforms, i.e. safety of personal data? Do you know who has access to your data?
Social network
1. How confidently people are interacting socially over the internet. 2. Engaging with professional and nonprofessional advice. 3. Skill to use mobile devices. 4. Availability of apomediaries (intermediaries of ICT use) for relevant and trustworthy sources.